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ELECTRICAL REVIEW.

VOL. LXXVIII. MAY 26, 1916. No. 2,009.

ELECTRICAL REVIEW.

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THE INTERCONNECTION OF ELECTRICITY SUPPLY UNDERTAKINGS.

WE have followed with the keenest interest the recent discussions at the Institution of Electrical Engineers on the proposals put forward by Mr. Ernest T. Williams for the reorganisation of electricity supply in this country, on the bases of centralisation, co-operation, and interconnection, and have cordially welcomed the new spirit which seems to be stirring the dry bones of this exceedingly important branch of the industry. Hitherto, to judge by the actual course of events, the watchword of most undertakers of electricity supply, whether company or municipal, and of most engineers connected with them—but, happily, not all—has been "every man for himself"; the petty jealousies of municipalities and of supply engineers were freely blamed in the Manchester discussion for the failure to secure co-operative working between them, although the fact was clearly recognised that very great advantages could be derived from a policy of interconnection of systems and genuine co-operation, particularly in such densely inhabited industrial areas as those of South Lancashire, Yorkshire, and Birmingham. But there was ample evidence that the national importance of the matter, the changed conditions, and the general awakening of the nation to the imperative necessity of placing efficiency and economy above all minor and local considerations, were bringing about a new attitude of mind towards such questions, and that the time was ripe for action.

We were, therefore, intensely pleased to receive from the Board of Trade a copy of a letter which it has addressed, under date May 25th, to all electric supply undertakings in the United Kingdom, in the following terms:—

The Central Coal and Coke Supplies Committee have had under consideration the increasing difficulty in providing for the supply of coal to important consumers, and have advised the Board of Trade that in view of the possibility of a serious shortage in the near future every practicable economy in consumption should be adopted without delay.

In this connection the Board desire to call attention to the very considerable saving that can be effected by the adoption of arrangements for interconnection and joint working of electric supply undertakings, including interconnection with stations supplying tramways and railways.

The Board are aware of the difficulties involved at the present time, particularly in regard to labour and materials, but they are advised that in many cases the necessary arrangements could be made at once, and they wish, therefore, to urge upon electric supply undertakers the necessity in the national interest of taking immediate steps to avail themselves to the fullest possible extent of the powers which exist for the purpose.

Any application which may be made to the Board of Trade for their approval of such arrangements under the powers conferred on them by the Electric Lighting Act, 1909 (Section 4. Sub-section 3) and the London Electric Supply Acts, 1908 and 1910, will receive their immediate attention.

The Board are prepared to assist as far as possible in cases where difficulty is experienced in securing the agreement of all the parties interested in any proposed scheme, or in arranging the terms and conditions under which it shall be carried out.

The importance of this step can hardly be exaggerated, not only in its bearing upon the conditions which exist in war-time, but also in its effect upon the whole future of electrical engineering in this country. We heartily congratulate the Board upon its prompt action, and upon the intention, which is plainly manifest, to follow up the policy suggested. We would gladly see it go further, and obtain com-

pulsory powers to enable the Board not merely to "urge upon electric supply undertakers the necessity in the national interest of taking immediate steps," but also to ensure the adoption of its suggestion. This is no time for coaxing and wheedling; what the nation is crying out for is government with a firm hand. We have seen the lamentable results of the former policy in only too many instances; we have seen also how readily and willingly the nation complies with an order backed up with energy and decision. To be effective during the war, the policy of interconnection must be put into force *at once*.

The immediate benefits to be derived from this course chiefly consist in economy of fuel, the expressed purpose of the Board, and the release of stand-by plant to cope with the increased demand for power. These features may at first sight appear to be somewhat conflicting, but a little consideration will show that the small and inefficient power stations can be utilised as a reserve to the large stations equipped with modern economical plant; the latter will be able to supply a greatly increased demand, and yet show a great reduction in the aggregate consumption of fuel. No interference with local management of the distribution of electrical energy is necessary, at any rate for the present, and we feel sure that station engineers, a most patriotic body of men, will heartily support a movement which is shown to be of advantage to the nation, while their private interests can readily be safeguarded, if they feel it to be necessary. We trust that no time will be lost in pressing on with a proposal which we believe to be of the first importance to the nation, to the electrical engineering industry, and to every consumer of light, heat, and power throughout this country.

The Future in Russia.

In discussing the future of trade in Russia we have on several occasions expressed the opinion that Germany's influence in that and other markets would wane as the financial difficulties within the Central Empires developed, rendering necessary or politic the disposal of securities in electrical and other engineering undertakings. Of course, whether the weakening would be temporary or permanent would depend to some extent upon the ability of German interests to re-purchase the securities after the war, and upon whether they were transferred to friendly hands in neutral lands as a matter of war convenience. Present indications do not suggest that such ability will be very substantial, but there are certain signs that transfers are being made.

Another very important point to which we have also already alluded several times is the need for engineering industrial development in Russia, by Russians, and by nations which are now their Allies. Engineers, at all events, have long recognised that Russia would have been able to withstand the German and Austrian offensive last year with even greater brilliance and effect—indeed, the war might never have come at all—if she had been more advanced as an engineering and industrial nation. We may judge from the many utterances that have been made by responsible statesmen, scientists, engineers, and industrial authorities in Russia, that this aspect of the situation is as keenly appreciated there as it is here. They have a land of vast resources, and they desire to release it from the strangling grip of the Teuton.

Both of the foregoing matters are referred to in a very businesslike interview which "Sergius," of the *Daily Chronicle*, has had with Mr. A. Protopopoff, the vice-president of the Russian Duma, who, we are told, is looked upon as the future Russian Minister of Trade and Commerce. His great desire seems to be to revolutionise the whole of Russian trade—if he succeeds in revolutionising only a part of it he will have done much to open the way for the development of closer relations with British finance, industry, and commerce. He recognises the need of British capital, says that the desired guarantees and facilities that our capitalists require will be forthcoming, flouts the opinions of those Russian economists who blindly demand a complete control over the capital, and who want only Russian engineers and workmen to be employed, leaving the English capitalist merely a dividend. Mr. Protopopoff says: "Give us English Engineers, English managers, and even English skilled workmen. We will learn from them. We are going to open wide our doors to Allied capital . . . and see that such conditions are created . . . as will facilitate the turnover of capital." Railways will be required on an extensive scale; gold, iron, and coal mining industries clamour for development, and after the war "we shall build up new industries and develop the old ones, and thus emancipate ourselves." It may be that in the readjustment of affairs, when the war is ended, there will not be very much capital free for such purposes immediately. But Mr. Protopopoff will, as time passes, and as the position comes to be tackled, see that finance is but part of the huge problem, and British manufactures will be wanted by the million sterling if the German yoke is to be flung off. His sympathies, we are sure from other comments made in the interview referred to, will lead him to advocate the facilitation of British trade quite as enthusiastically as he now argues for British finance, which is promised a fair return, "perhaps many times greater than the profit on . . . manufactured goods." He praises highly the efforts of his friend, Prince Shahovsky, the present Russian Minister of Trade and Commerce, to bring about closer business relations between the two countries, urges the organising of visits of British business men and experts to Russia, and the setting up of an Official Information Bureau. He is careful to warn British manufacturers and capitalists against throwing themselves haphazardly into Russian enterprises, and in this he is but preaching what we have ourselves long advocated, a policy of unity and co-operation in a strong effort on the part of British electrical and engineering manufacturers to build up a thoroughly sound organisation equal to the immense possibilities of the situation. All efforts to this end may not be as free from set-backs as we might desire, and some appear to be delayed because we are lamentably short of the right type of men to carry these operations through with experience and authority. We trust, however, that some of the financial minds of the British Empire have their attention fixed upon the concessions, electrical and other, the hold upon which Germany is now being driven to loosen. These may be regarded in many cases as key concessions to fit and turn the lock of industry.

German Realisation of Foreign Securities.

In connection with what we have stated above, we are informed that a movement is in progress in Germany in the direction of taking advantage of the opportunity afforded by the present rate of exchange for disposing of securities held in undertakings in neutral countries, whilst, at the same time, these countries are exhibiting a greater desire to nationalise electrical works. Among the recent transfers may be mentioned the sale by the Frankfort Lahmeyer Co. of its Wangen electricity works in Switzerland for a sum of about 9.000.000 fcs. (£360.000), and the disposal by the Berlin Electrical Undertakings Co. of shares for 1.136.800 crowns in the Christiania tramways; it is stated that the transaction yielded a good profit, which could not have been obtained in normal times. A further opera-

tion of considerable magnitude relates to the Nuremberg Schuckert Co., which, as stated last week, has succeeded in transferring to a Norwegian syndicate, for a cash payment, its large holding of shares in the Aktieselskabet Hafslund. These, again, are said to have been sold at a large profit, and they represent a total value of about £720,000.

Rubber.

The rubber market has been of late rather severely depressed, not because of any material deterioration in the outlook as to the future outlet for the commodity, but chiefly in consequence of the fact that the export trade has been seriously handicapped by the difficulties experienced in the way of getting permits for shipment to neutrals, more particularly the United States. There is as yet no indication of any material improvement in that direction, and this naturally continues to prejudice the general demand to an extent which must be expected to keep the warehouse stocks on this side in rather unwieldy proportions. It seems unfortunate that the progress of the industry should be so much hampered by the action of the authorities, the reason for this not being quite clear, although it is suggested that demands for permits were at one time forced to a degree which tended to make the authorities more circumspect, possibly partly because of the persistent tightness of shipping. These adverse conditions are clearly reflected in the Board of Trade Returns for the past month, showing a very big falling off in the quantities dispatched to the United States, the total against the previous year marking a deficit of over 4,300 tons, while it is well under the tonnage accounted for in the same month two years ago. The exports to allied countries were fairly well maintained. As compared with the large shrinkage in the exports, the decrease in the imports was comparatively small and due to a falling off in the shipments from the Near East, probably on account of freight scarcity. The result, therefore, has been an inevitable swelling of the stocks, the existence of which is obviously making itself felt, the home stocks being considerably larger than for some years past. There is no mistaking the fact that export buyers have now still to contend with many difficulties as regards freightage and licences, and until these drawbacks are to some extent remedied, it is hardly likely that the position of spot rubber will mend to any appreciable extent, although arrivals look like being smaller for some time. The total shipped during last month from the Federated Malay States was, according to official returns, only 3,904 tons, against 4,429 tons for the previous month, and 2,777 tons for April last year. The aggregate for the four months amounts to 18,011 tons, which is an increase of about 5,000 tons against last year, and almost double the returns for the same period two years ago. The tendency of prices for weeks past has been most irregular, the depression in spot and near rubber down to 2s. 9d. per lb. (from which a temporary rally ensued of about 3s. per lb.) contrasting sharply with the comparative firmness which has characterised forward rubber, the latter having been invariably maintained at a fair premium due to a well-sustained demand which, however, has been chiefly met by dealers. The estates are apparently still reluctant to take advantage of this satisfactory feature. Dealers have thus been tempted to increase their operations while repurchasing on the spot at a discount some of the rubber sold short forward. For the time being, consumers confine their purchases to near requirements, so that the market is largely in the hands of dealers. The backward attitude of producers has come in for some criticism, for the prices obtainable for forward delivery seem attractive enough. The course of the market to some extent depends on the proportion of the quantities reaching this side unsold.

LABOUR AND INDUSTRY.

For some years prior to the outbreak of Germany's war upon Civilisation we were deeply absorbed in the domestic questions which were constantly arising in consequence of the progress of British Democracy. Those to whom it falls to write the history of those days will probably record against us that we were so much involved in embittered controversy, and so angrily engaged in internecine struggles, that we were, as to the majority of us, allowed to remain oblivious to the terrible danger that was gathering force, lifting its ugly head, and hardening its mailed fist, in readiness for the great spring forward, striking the blow which should give Germany World Domination. The Enemy happily was unable accurately to estimate the British character and the Oneness of Heart of our Empire, or to foresee the ability of the Allies to act in so grand a spirit of unity and fortitude against the Terror of Europe. The guardian of the Law who enters to interfere in the domestic differences between husband and wife knows from long experience that he is inviting the combined attentions of both parties, who put aside their own comparatively trifling differences in order to visit the full force of their vengeance upon the intruder. Such, in the main, has been the penalty incurred by Germany from the combined forces of British Capital and Labour. At the appointed Day the vast forces of Prussian militarism were let loose with thirst for blood and lust and plunder. Husband and wife flew at the new-comer, their common interests deciding that his intentions were more dangerous than were the internal grievances which brought about the domestic blows. It has been an exhausting struggle extending over nearly two years, but the intruder is kept at bay, and if only the combined effort can be maintained he will be sorry for the intrusion before long—indeed some reports suggest that there is a very deep sorrow already, and that much would be given by Germany and Austria, by Turkey and by Bulgaria, could they see reasonable justification for hopes that they will ever return to the highly favoured state in which they existed before the first shell was fired in August, 1914.

The British and Allied determination, as grim as it is unalterably fixed, is that they never shall so return.

But when the aggressor has been beaten to his knees and permanently defeated, shall we celebrate the Peace by a renewal of our old quarrels between Capital and Labour? We trust not, after all the sacrifice that has been mutually borne by both classes on the fields of blood and slaughter; yet we shall still be a British Democracy—the war has not wiped that out of the national character; our relations will still be those of master and man; and whatever developments may take place altering parties and party politics, there will still be motives and ambitions, purposes and objects, bringing different classes and different minds into conflict. We wish we could agree with those who think that the life and death of the trenches are to have a subduing and a soothing influence which will outlast the very serious difficulties of demobilisation. There are millions for whom the only "trench" during these two years has been the factory at Home, and amongst these a "high wages habit" has been established; and hundreds of thousands, either through disablement or death, or the liking for open-air life, will never return to factory life.

We need to remember that for many years prior to the war the workers were struggling and fighting periodically in individual trades—almost incessantly if we consider all trades together—for concessions from employers, from Capital and from Industry. During the war these workers have been told almost to the point of weariness that they by their efforts are winning the war quite as much as the men with the fighting Forces. Is it to be supposed that they will forget that fact after the war when they renew their claims? Already the Voice of Labour has been letting us know in very clear tones that the fruit of former struggles, what are termed the rights of the worker, the better wages, the shorter hours, the improved conditions, must not be filched from them as a result of the war. Have they not had the definite promises of responsible legislators that they shall not be so robbed? The inevitable economic consequences of the war, the inability of industry to carry all the burdens that it is

sought to impose, the effects of supply and demand upon employment, these and other factors may exert an influence in connection with the fulfilment of those promises when the time comes. But with all the softening influences and all the promises of ministers, human weaknesses will remain, and we shall be guilty of the gravest of errors if we count too much upon the approach of an Industrial Utopia after we are at Peace again, especially remembering that during the last two years, when we have been fighting for our lives against the enemy, there have been frequent rumblings of discontent in Labour circles, and disgraceful unwillingness in some parts of the country to rise to the occasion and increase the output of munitions of war and of ships. Even during the last few weeks our newspapers have been reporting disaffection in many trades, and everybody knows that Labour's eyes have recently been turned somewhat longingly in the direction of Australia and New Zealand, where wages are higher, where pensions are larger and are paid at an earlier age than here. One Labour spokesman has declared that if Labour swallows the Australian policy of Protection it will want these compensations in return. Other Labour men hold that they cannot have such rewards unless the economic position is rectified along Protective lines.

We have, of course, no desire to exaggerate the possibilities of the situation, but manufacturers' associations have not been slow to recognise the importance of facing the Labour problem as far in advance of demobilisation as is practicable. The Government has its committees studying the question, and Labour, through its organisations, is engaged very seriously formulating proposals for securing the position of the working classes after the war. We give below some of the proposals that have been advanced, as we think it most necessary that those interested in industry should keep themselves informed respecting the policies, principles, and aspirations to which certain sections of the workers have announced adherence.

In April the following programme was adopted by what is called the Triple Labour Alliance; this Alliance consists of the Miners' Federation of Great Britain, the National Union of Railwaymen, and the Transport Workers' Federation: —

1. That any departure from Trade Union practices which have been made to accelerate production and distribution shall terminate upon the resumption of peace.
2. That all workers, whether men or women, who have been employed as substitutes shall be on their disemployment, provided with other work at the standard living rates or with full maintenance by the State.
3. That the Government be urged to arrange for the demobilisation of all those who have joined for the duration of the war in such a manner as shall lead to their gradual absorption into their civil occupations.
4. That all men desiring to do so shall be granted extended furlough on full Army pay and separation and billeting allowances in order to recuperate themselves at the end of the war.
5. That a registration bureau be set up with management powers half of which shall be Trade Union representatives appointed by the various Trade Unions with full executive power, in order to deal with the transition stage, and that men who had severed their connection with the Army who cannot procure employment shall be insured full employment by the State.

It will be observed that this Alliance is a very strong one, composed of organisations representing millions of workers whose occupation is vitally necessary for the maintenance of the industrial and ordinary life of the Kingdom. In (1), it sets up a claim for what has been promised under pressure of the most exceptional circumstances. Yet the fact remains that those who gave the promise on behalf of the nation have been loud in their condemnation of trade union practices because they meant limitation of output in the critical periods of war when we have been fighting for our lives and when the maximum effort of the nation was essential. Those who have studied such industrial questions in peace time during the past 10 or 20 years, and feel some anxiety in regard to the industrial conditions that will follow the war, realise that deliberate limitation of output—in other words, "trade union practices"—is as heavy a millstone round the neck of manufacturing industry for peace-time development as it proved to be in the production of munitions of war. It is profoundly hoped that Labour will have seen the error of its ways for itself—we are all learning lessons in practical experience in these trying days, and Labour, ready as it may be to fight for what it may call its "rights," must be induced to learn the seriousness of its responsibilities in relation to after-the-war production. Items No. 2 to No. 5 in this programme present demands which, of course, do not err on the side of modesty; there is apparently no bottom to the Empire purse! But these are points for the discussion of which the time is hardly ripe. The problem of demobilisation will call for anxious thought from the entire nation — from legislators, from industrial employers, and from labour organisations. To a large extent whatever after-war burdens are imposed will become a tax on industry, and the worker needs to learn that the burdens of industry must inevitably in the long run be passed on to the worker in some form or other, perhaps as unemployment consequent upon restricted business in some trades. At the moment we are not called upon to discuss these demands further; authorities have been appointed to investigate the prospective situation, and their findings will give us a basis for discussion in due course. It is announced that while the big combined organisation referred to has formulated the proposals given above, in other labour circles there is a disposition to investigate separately before adopting a programme. For instance, it is stated that a number of Trade Union leaders have appointed a Special Joint Labour Committee to report on labour problems after the war. It will consist of the following members, representing the organisations named: —

Trade Union Congress.—H. Gosling, W. Thorne, M.P., and C. W. Bowerman, M.P.
Labour Party.—G. J. Wardle, M.P., J. R. Clynes, M.P., and J. R. MacDonald, M.P.
Workers' National Committee.—Robert Smillie, A. Bellamy, and Sidney Webb.
General Federation of Trade Unions.—Three members not yet appointed.

Everything is to be gained by the most exhaustive study of the problems by Labour, especially if while the war lasts, it can bring to its deliberations some of that spirit of the trenches about which we hear so much. It is to be hoped that in such deliberations the questions will not be viewed short-sightedly. The rights and the best interests of Labour will be more permanently safeguarded if the problems of national industry and trade, and their bearing upon employment and unemployment, are carefully and sympathetically studied as a whole. Labour and Capital both need to take a long view in the critical inquiries and negotiations that should lead on to reasonable compromises in the interests of the entire Empire. To advance extravagant demands without due regard to the question of national trade policy, and to the need for protecting ourselves in some way or other against the outside aggressor, if and when he resumes his characteristic trading methods, will be a hindrance to peaceful and satisfactory inquiry.

We are sympathetically drawn by some parts of the programme of the British Workers' National League, whose recent magnificent initiatory meeting at Queen's Hall was addressed by Mr. W. M. Hughes, the Prime Minister of Australia. The avowed objects of this League are: —

1. The application of the War's emphatic lessons (1) that Competition and Private Profit-Seeking lead to Waste, Inefficiency, Fraud, and National Disunion; and (2) that the full Expansion and National Use of National Resources in Peace or War absolutely depend on the National Control of Vital Industries under the joint management of administrative and manual workers in the interests of the whole nation.
2. The establishment on a democratic basis of defences adequate to the Empire's security, by the recognition of every citizen's duty to defend the life of the State. This naturally involves the State's reciprocal duty to guarantee the citizen's right to live—that is, the right to work at a full living wage.
3. The Federation of the British Free States under a governing council, representing all portions of the Empire, for the direction of Imperial and Foreign policy.
4. The modification of our international commercial policy, with a view to the political and economic defence of the British States and their Allies.
5. Educational reform on a national scale to secure greater technical efficiency combined with more democratic general access to knowledge.
6. Drastic agricultural reform to secure the full scientific development of the land in the national interest, with especial regard to the employment of ex-soldiers and sailors.
7. The realisation of free democratic government based on Universal Adult Suffrage, instead of the actual Government by caucus and money-power.

We do not propose to comment upon all the planks in this platform—they do not fall immediately within our industrial scope; but No. 4, relating to the future commercial policy of the British States and their Allies, was the one point upon which the speakers were unanimously emphatic, and the one which the vast audience vociferously cheered again and again. Making full allowance for all the glamour that would be cast around the proceedings by the presence of a Labour Prime Minister from the Antipodes, who had come Home to strike a definite note when so many other voices were weak or silent, we have to say that the definiteness and strength of the speeches of Labour men left no room for doubt about their enthusiasm for an Imperial Labour policy such as Mr. Hughes has been urging all along. To our mind, so far as British Labour Trade policy is concerned, the speech of the chairman, Mr. Hodge, M.P., was as important as that of Mr. Hughes. In brief, both of them recognised that the workman cannot expect to secure higher wages and to realise the ideals of a healthy and virile population unless the manufacturer "knows where he stands." It will help us to understand the importance of this movement, in relation to those of other Labour sections which condemn anything in the nature of an economic war with Germany, if we give the names of the men who are more prominently associated with the League:

Chairman.—A. M. Thompson.
Hon. Sec. and Treasurer.—Victor Fisher.
[To whom all communications should be addressed at 22, Buckingham Street, Adelphi, W.C.]
Assistant Hon. Sec.—Irene Fisher.
Chairman Organisation Committee.—J. A. Seddon.
Vice-Presidents.—Right Hon. W. Abraham, P.C., M.P., Right Hon. W. Crooks, P.C., M.P., Charles Duncan, M.P., John Hodge, M.P., James O'Grady, M.P., C. B. Stanton, M.P., Stephen Walsh, M.P., A. Wilkie, M.P., H. G. Wells.

The Queen's Hall meeting is to be followed by similar big gatherings organised by the League; these are to be held in different centres of the provinces, stimulating or focusing the opinion of Labour.

(*To be continued.*)

G.E.C. CADET CORPS.

In most of the large and industrial concerns in the country considerable numbers of youths, between the ages of 15 and 18 years, are employed. Many of them have been Boy Scouts, and, if they are given the requisite encouragement, they will take an active part in making themselves fit for military service when they reach the legal age for enlistment. It is, however, desirable that the encouragement take the form of practical support from their employers, and undoubtedly much good work can be done to establish an active Cadet Corps among the youth of manufacturing undertakings and commercial houses. We learn that Mr. H. Hirst, the chairman of the General Electric Co., Ltd., has instituted the G.E.C. Cadet Corps (attached to the Sussex Yeomanry), which has now been on an active footing for nearly two months, and which, we hear, is already at "full strength."

The uniform and equipment, comprising khaki tunics, breeches, caps, belts, haversacks and puttees, have been supplied to the Corps by the company without charge. What might have proved an insuperable difficulty in the formation of the Corps has thus been removed by the generosity of the company.

The first Corps is commanded by Captain E. A. Joyce, who has on his staff First Lieut. A. V. Cannon, and Second Lieut. W. F. Arnold. We reproduce a portrait of these officers herewith. This Cadet Company is attached to the First Cadet Battalion of the Sussex Yeomanry and is 112 strong, consisting of two platoons. Khaki uniform is worn, and both officers and "men" are recognised by the War Office.

The training is given in accordance with the 1914 Infantry Training Regulations, and we understand that the Corps, although it has been in existence a comparatively short time, is already displaying marked ability. We gather that the cadets are put through a regular course of shooting once a week at the 10 target range at the Cripplegate Institute. Squad and Company drill is undertaken on Friday evenings at the Institute, and on Saturdays the Corps, by permission of the Inner Temple Gardens' Association, drill in the Temple Gardens, which should prove an ideal ground for the purpose. It will be seen, therefore, that the movement is proceeding upon "regular" lines, and that the training will be of immense value as preparatory work to that which will be undertaken when the Cadets come to be called up.

Officers of the G.E.C. Cadet Corps.

The G.E.C. Cadet Corps.

More than ordinary interest attaches to the Corps, because it has been brought into existence by the help of the management of the General Electric Co., who inform us that not only is the training of immense value in developing the physique of the lads, but it contributes considerably towards increased efficiency in business by making them take a greater interest in themselves, by accustoming them to discipline, by improving their manners, and last, but not least, by the establishment among them of *esprit de corps*.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Small Humphrey Type Pumps.

We illustrate herewith (fig. 1) an interesting development of the Humphrey gas pump, which, as our readers will remember, was originally designed to deal with water in bulk quantities, to meet the requirements of waterworks and for similar duties.

The new type of pump has been developed for small uses, which are, of course, much more numerous than the large ones, and at present two sizes, with power cylinders of 3 in. and 6 in. diameter respectively, are made. The new pumps work on a two-stroke cycle

The power cylinder at the top contains a piston, with the piston rod projecting through the top cover and attached to a heavy metal crosshead, circular in shape (shown resting on the cylinder head in our view). This crosshead is connected by side rods to a lower crosshead, which in turn is connected to the pump bucket in the pump at the lower end. The power cylinder has a mechanically operated exhaust valve at its lower end, and, part-way

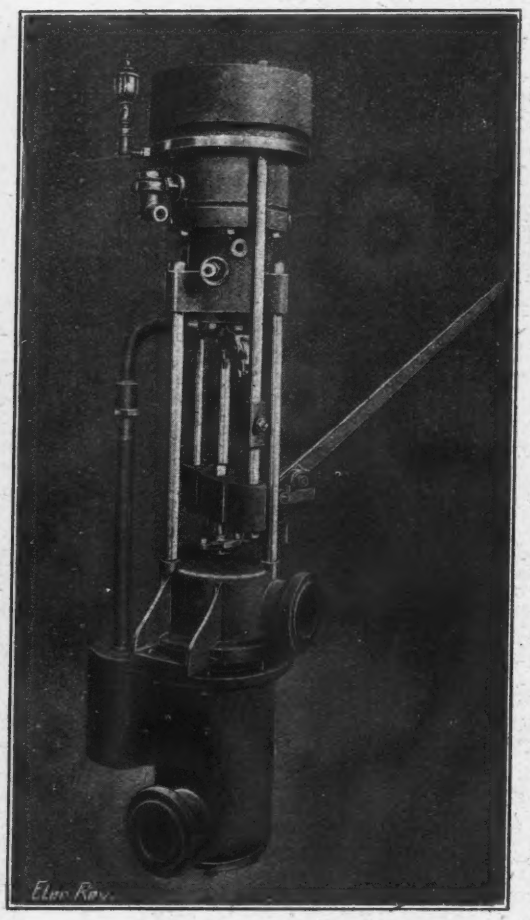


FIG. 1.—HUMPHREY GAS PUMP.

up, a row of gas and air inlet ports. Assuming the piston to be at the bottom of its stroke, with a compressed gas charge below, on ignition of the charge, the piston, with the crossheads, &c., and pump bucket, is forced up—the bucket forcing out the water above it and drawing in fresh water beneath through a foot valve.

In the power cylinder the upstroke of the piston has compressed a charge of gas and air in the cylinder top and mixing chamber with which the ports communicate. The piston overruns the ports and the compressed charge then enters the cylinder, assisting to drive out the burnt gases through the exhaust valve which has opened in the meantime. The exhaust valve closes and the piston with the weighty parts connected to it falls, compressing the new charge again ready for the next stroke.

It will be noted that the pump movements are gas-cushioned, but as a precaution a corrugated rubber pad is placed on the cylinder head to cushion the falling crosshead if necessary.

The explosive charge is ignited electrically, but under some circumstances the charge may ignite itself; if pre-ignition should occur it would only shorten the working stroke of the pump.

The water ends are made in various sizes to suit the quantity of water to be pumped, which becomes less as the head increases. For instance, the 3-in. pump output varies from 9,200 gals. per hour at 8 ft. head to 575 gallons at 172 ft.; the 6-in. pump output varies from 46,800 gallons an hour at 12 ft. head, to 1,500 gallons at 500 ft. The 3-in. pump weighs 350 lb. and the 6-in. 1,630 lb. the former consuming approximately 20 cb. ft. of gas or ¾ pint of petrol an hour.

"Holdfast" Lamp Guards.

The L.P.S. ELECTRICAL CO., of 18, Adam Street, Strand, W.C., are introducing the patent lamp guard—the "Holdfast"—for glow lamps, shown in fig. 3, consisting of a clamping collar, forming a rigid guard to the socket, from which is suspended a wire cage containing an internal spiral-spring cushion fixing the position of the lamp bulb. Between cushion and guard there is a 1-in. clearance which not only protects the lamp from jars, but keeps it at a safe distance from anything combustible. A special trap lock prevents the unauthorised removal of the lamp. These guards have been in use 11 years and are guaranteed; they are designed for all lamp sizes from small carbon to 1,000-watt pear-shaped metal-filament lamps.

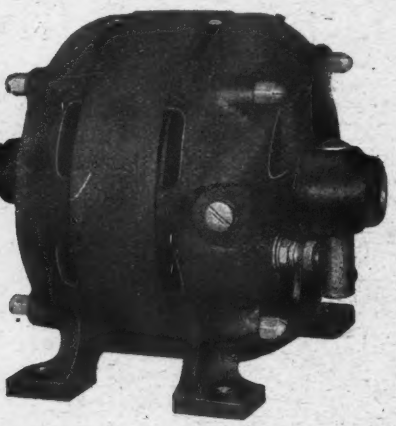


FIG. 2.—B.T.H. ¼-H.P. MOTOR.

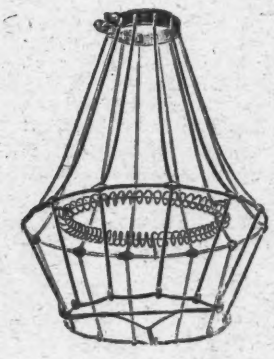


FIG. 3.—"HOLDFAST" LAMP GUARD.

"Verilux" Glass.

"Verilux" is a new three-ply glass, which has recently been placed on the market by The GENERAL ELECTRIC CO., LTD., of London, designed to produce, in combination with tungsten lamps, a close and permanent approximation to daylight. The inmost layer of the glass is a colour-straining medium, the next is a diffusing medium, and the outside layer is of clear glass to provide the necessary "body" or strength. Light transmitted through this glass emerges as a precise imitation of daylight, and is free from glare. There is no restriction on the shape or dimensions of the globes made for this purpose, but the best results are obtained with the deep bowl or the spherical types (fig. 4), which ensure that practically all the rays are transmitted through the glass.

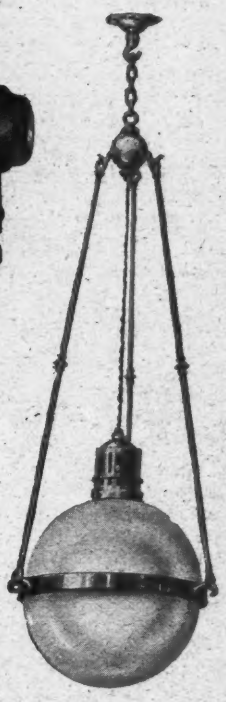


FIG. 4.—PENDANT FITTED WITH SPHERICAL "VERILUX" GLASSWARE.

Owing to the high efficiency of the Osram and Osram-Atmos type lamps, the loss due to absorption by this glass is, for all practical purposes, unimportant, but in any case the commercial value of artificial daylight is so high that a slightly lower efficiency will not affect the popularity of the "Verilux" glass. There are many industries which, for want of such an invention, can be carried on for only a few hours each day during the winter months; the number and variety of such industries is much greater than most people imagine. In domestic and office lighting there is also a field which is worth cultivating.

Small-Power Motors.

The BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, has put on the market a series of motors of very small powers, for which the qualities of cheapness, efficiency, and reliability are claimed. One of them is illustrated in fig. 2; it will be noticed that the field-magnet consists of steel laminations, riveted together, and forming the main frame of the motor, to which the malleable-iron end-shields are bolted. The latter contain the bearings and brushes; the bearings are fitted with grease cups on the underside, arranged for wick lubrication. The figure shows a D.C. motor (type S.D.,

¼-H.P., 110 volts), but single-phase motors are also made, very similar in appearance and construction; the sizes range from $\frac{1}{250}$ to ½ H.P., at 110 and 220 volts, 50 cycles A.C. and D.C. The D.C. machines of type S.D., up to $\frac{1}{10}$ H.P., are shunt-wound, larger sizes compound-wound. From $\frac{1}{250}$ to $\frac{1}{15}$ H.P., both A.C. and D.C. motors are designed with series characteristics, and have commutators; the A.C. motors, type S.A., from $\frac{1}{10}$ to ½ H.P., are of the split-phase induction type, with the primary winding on the rotor, and the secondary on the stator; at full speed the starting winding is automatically cut out of circuit. Carbon brushes are used in all cases, with fixed holders.

Small Shell Inspection Lamp.

Messrs. Ward & Goldstone, of Sampson Works, Salford, Manchester, are placing on the market a small type of shell inspection lamp specially designed for inspecting small shell interiors. A feature of the lamp is that the guard protecting the bulb is only ⅝ in. in diameter; a proportionately small bulb is used and is energised from a dry battery, the handle being fitted with a push contact so that current is not wasted when the lamp is not in use.

A long length of flexible is provided connected to the battery; the firm's "Volex" 4-volt batteries give from 80 to 250 hours for intermittent use.

LEGAL.

Hill *v.* John Lysaght, Ltd.

In the King's Bench Division, on May 16th and 17th, Mr. Justice Bray and a special jury heard an action brought by Albert Edward Hill, an electrical fitter, against John Lysaght, Ltd., London and Bristol, to recover damages for personal injuries sustained, as it was alleged, through the alleged negligence of a servant of the defendants, who are a firm of ironmasters and engineering contractors. The defendants denied the alleged negligence.

Mr. Vachell K.C., and Mr. S. Duncan were for the plantiff, and the defendants were represented by Mr. Clavell Salter, K.C., and Mr. Raynor Goddard.

The case for the plaintiff was that the defendants in July, 1915, were engaged on certain Government constructional work in the eastern counties in connection with a large shed with galvanised iron sides 300 ft. long, 100 ft. broad, and 50 ft. high, the work being very urgent. The task of putting in an electrical installation was in the hands of the firm of G. E. Taylor & Co., and it was by this firm that the plaintiff was actually employed. The plaintiff was employed running metal tubes over the building, electrical wires, and fixing fuseboards. While he was thus engaged working on a high scaffolding, an employé of the defendants, who was higher up, dropped a heavy bolt which struck the plaintiff on the left forearm with great violence, causing a lacerated wound. He suffered from this for a long time and also from nervous troubles consequent on the injury and shock. The plaintiff gave evidence to bear out these statements, and denied that he was warned on behalf of the defendants against working on the electrical fittings while the men were working on the iron girders above. Other employés of Taylor & Co., who were engaged with the plaintiff, deposed that no warning was given by any of defendants' men as to danger overhead.

Archibald Lowe, the foreman of Taylor & Co., said he always warned his men to look out for others above them, and he had on occasions found his men working elsewhere if they found the ironworkers were too close.

Mr. Clavell Salter, K.C., submitted that there was no evidence of negligence against the defendants.

Mr. Justice Bray said that the case was "very near the line," and he would hear the evidence called on behalf of the defence.

Mr. Salter, K.C., in opening the defence, said that the employés of Taylor & Co. were continually warned by the defendants' foreman of the danger of working beneath the men engaged on the iron work, but all the warnings were disregarded. Work of this character was necessarily dangerous, and the dropping of bolts, tools, &c., occurred without negligence. The evidence showed that the plaintiff was not bound to work at this spot; and Taylor's men were continually warned of the danger of working under the men on the ironwork. He asked the jury to say that the claim against the defendants was unfounded, and that the real liability lay on the plaintiff's employers, Taylor & Co., or the insurance company by whom they were insured.

Mr. Geo. Carpenter, defendants' foreman, gave evidence, and, in the result, the jury returned a verdict for the defendants, for whom judgment was entered, with costs.

Knowles *v.* Electrolytic Plating Apparatus Co., Ltd.

On May 18th, the Lord Chief Justice, Lord Justice Warrington, and Mr. Justice Lush, heard an appeal respecting the sale of a quantity of nickel anodes for electro-plating. The appeal was from a decision of Mr. Justice Bailhache, at Birmingham Assizes, and the parties to the proceedings were Mr. J. W. Knowles, of Oldbury, and the Electrolytic Plating Apparatus Co., Ltd., of Birmingham.

Mr. Maddocks, for Mr. Knowles, explained that Messrs. Shaws, Ltd., of Willenhall, sold a number of nickel anodes to Messrs. A. S. Smith & Sons, of Walsall, and they resold them to the Electrolytic Plating Co. The last-named firm sent, at the request of Messrs. Smith, a cheque for £105 to Messrs. Shaws, and the cheque passed to Mr. Knowles, a debenture-holder of Messrs. Shaws. The Electrolytic Co., finding, as they alleged, that the anodes were of no value, stopped the cheque. Mr. Knowles at once took legal proceedings on the cheque, alleging that having received value for the money the Electrolytic Co. could not legally stop the cheque. The Electrolytic Co., however, counterclaimed for breach of contract with regard to the anodes, but Mr. Knowles contended that having received the articles from A. S. Smith & Sons, the remedy of the Electrolytic Co. was against that firm and not against him or Shaws, Ltd., at all. Mr. Justice Bailhache held for Mr. Knowles on the counterclaim by the Electrolytic Co., and for the last-named company on the claim by Mr. Knowles. Consequently, both parties appealed.

Their Lordships, on Friday, dismissed both appeals, with costs. The Lord Chief Justice said that to succeed Mr. Knowles would have to show that Shaws, Ltd., supplied nickel anodes, whereas it seemed a fact that what they sold to Messrs. Smith was scrap nickel. Consequently, the Electrolytic Co. did not receive value, and were entitled to stop the cheque. On the other hand, to succeed in their counterclaim against Shaws for alleged breach of warranty, the Electrolytic Co. would have to prove that Messrs. Smiths bought the nickel as their agents. Seeing that it was a well-known fact that the Electrolytic Co. could only use anodes containing not less than 96 per cent. of nickel, it seemed improbable that Messrs. Smiths, had they acted as agents for the Electrolytic Co., would have bought for their principals scrap nickel containing 91 per cent. of nickel. Consequently, Messrs. Shaws could not be sued by the Electrolytic Co. for breach of warranty.

Scobie *v.* L.C.C.

Before Mr. Justice Bray, in the King's Bench Division, on May 18th, a special jury awarded Private Stewart Homer Scobie, a Canadian soldier, £500 damages against the London County Council. Plantiff, formerly a horse trainer at Saskatchewan, joined the Canadian Expeditionary Force, and was wounded in France. On October 11th, 1915, just before midnight, while crossing the Kennington Road, he was knocked down by one of the defendants' tramway cars, receiving such injuries that his right arm had to be amputated.

Munitions Cases.

An important ruling was given at a sitting of the Oldham Munitions Tribunal last week. A firm of electrical instrument makers charged an employé with having failed to work regularly and diligently on April 19th and following days. On April 18th the man applied for a leaving certificate, so that he could return to the mill, but his application was unsuccessful. He had not been back to his work since. The man now said he had not been at his work since April 5th, and had been out of work the full six weeks allowed under the Act before he could take another situation. The Chairman (Mr. James Hodgson) consulted with the assessors, and then announced that, in this case, an important point had been raised as to whether a man who left his employment with no intention of returning, was liable to a penalty, in addition to the punishment he voluntarily incurred by the loss of six weeks' wages. It was a point of law, and, accepting the man's statement that he had not worked since April 5th, he held that there had been no infringement of Rule 2, because he was not working on April 19th, the date on which he was charged with having failed to work regularly and diligently. No further penalty could be enforced, or the man would be penalised twice for the same offence. The case was therefore dismissed.

At the same Tribunal an electrical firm charged a youth with having neglected his work. It was stated that the foreman had had nothing but trouble with the youth, and what the latter really wanted was to leave his work and go into the Army. The firm could not commend his conduct, but believing that discipline would do him a great deal of good they were prepared to let him go into the Army. The youth now stated frankly that he had been asking the foreman for months if he would allow him to join the Army, but he had always refused. He was willing to join now. The firm's representative said the youth's conduct had been such that they would not be able to offer him a situation after the war, nor could they guarantee the allowance which they usually paid to dependents. The case was withdrawn, and the youth was sent off with the good wishes of the chairman of the Tribunal and also of the firm's representative.

A Peculiar Line Trouble.—The operator in a sub-station connected with a long-transmission line recently noticed that his lightning arresters were discharging regularly at short intervals. Since it was a clear day, and there was apparently no trouble on the line, he was at a loss to know the cause of the disturbance. The line was, however, inspected, and after going out from the station a distance of 19 miles, it was found that the galvanised-iron ground wire above the line had slacked off and was swinging in the wind. Every few minutes it would swing over within spitting distance of the line and cause a surge which resulted in the discharge through the lightning arresters in the sub-station 19 miles away. This is one example of the peculiar ways in which surges may manifest themselves, and travel along the line.—*Electrical World.*

SERVICE BRANCHES FROM EXTRA-HIGH-TENSION CIRCUITS.

By D. M. MACLEOD, M.I.E.E.

(*Abstract of paper read before* The Institution of Electrical Engineers *at Glasgow.*)

With the rapid growth and development of power supply from central stations generating and delivering alternating current, the problem of an efficient and economical mains lay-out has become of paramount importance. Every method must be tried to reduce to a minimum the outlay involved in feeder and network extensions, compatible with reliability of supply.

The ring-main system of distribution possesses undoubted advantages, one of the most important being that supply can be maintained to all consumers even though a fault should occur at one point on the ring circuits. To achieve the best results from this method of distribution it is essential that some system of balanced protective gear should be installed.

When a supply is required for a large power consumer, there is seldom any question as to its being obtained from or incorporated with the nearest available ring main, even should the consumer's works be situated some distance therefrom, as the importance of the supply on the commercial as well as on the engineering side is such as to justify the capital expenditure involved in looping-in the ring-main circuit and providing the necessary sub-station and balanced protective equipment.

In some cases, however, a comparatively small supply for an isolated works may be all that is required, or the return to be expected is totally inadequate to justify the heavy outlay that would be entailed in looping-in the ring-main cables. Under these circumstances the supply authority requires to exhaust every possible economical method of distribution in order to fulfil its obligations and ensure, at the same time, an adequate return on the capital employed.

In a number of cases the power supply required is too small to justify the cost of even a single branch with switch-house and consumer's sub-station equipment. Such cases can often be met, however, by the installation in lieu of the switch-house of an extra-high-pressure junction box; this course has been successfully adopted by the author during the past eight years.

The following table gives some indication as to percentage cost of various methods of delivering a supply of, say, 100 kw. to a point distant, let us assume, one mile from the line of route of a ring-main cable, it being understood that the point of supply is so far removed from any transforming station that a low-tension service line is not considered to be economically practicable.

(*a*) Cost of looping-in ring-main cable, auxiliary cables, and consumer's sub-station equipment 100
(*b*) Cost of laying branch cable and auxiliary cables, building and equipping switch-house, and equipping consumer's sub-station 64
(*c*) Cost of laying branch cable and auxiliary cables, link box, and equipping consumer's sub-station 53

The percentages are calculated for underground cables in each case. In the case of (*a*), overhead transmission is not admissible, as the expense of a double line built in accordance with Board of Trade requirements and accepted modern practice would show to very little advantage compared with underground cables laid in a common trench. Overhead transmission is, however, often quite admissible in the case of (*b*) and (*c*), and if adopted would make the percentage cost of these two methods still more favourable.

These figures show at once the economy in first cost in using branch services controlled from an extra-high-tension link box at the point of junction. The results achieved with these boxes have been uniformly successful.

Specifications and preliminary sketches clearly defining the functions and conditions to be met, were submitted in 1907 to the principal manufacturing firms throughout this country. At that time the application of link boxes to 11,000-volt circuits was considered to be so daring that one or two firms declined to tender. Fortunately, however, Messrs. Siemens Bros. submitted a design which clearly fulfilled all the requirements of the case, and which provided, in the author's opinion, a reasonable margin of safety both as to the insulation of the current-carrying parts and as to the safety of the operator. The design submitted was, subject to a few modifications, the one finally adopted by the power company with which the author is connected.

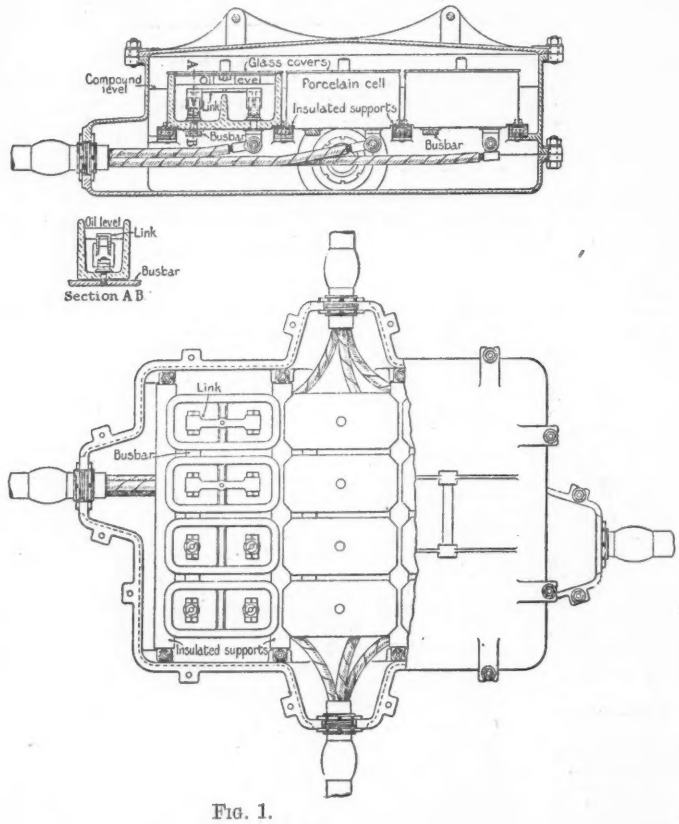


Fig. 1.

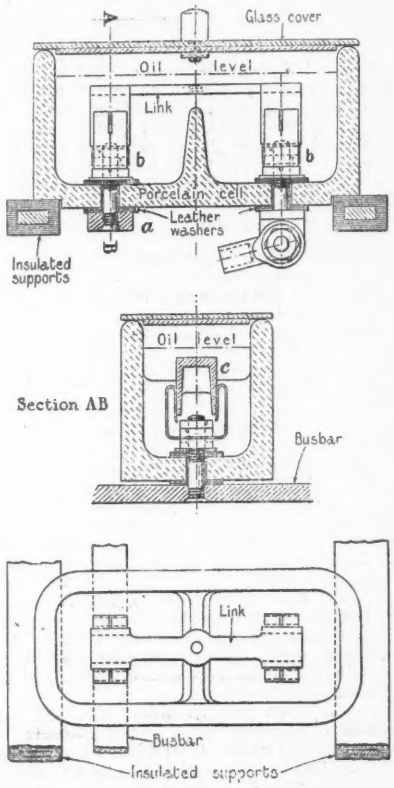


Fig. 2.

The general arrangement of the link box is shown in fig. 1. Each main and service cable is brought into the box in such a manner as to leave no doubt in the mind of the operator as to its identity. This very important feature is frequently overlooked in link-box design. All disconnecting boxes should embody in their design their own diagram of connections, thus leaving no doubt as to the route and purpose of each cable entering them.

The link box consists essentially of a rectangular cast-iron box in three portions, so arranged as to facilitate assembling and jointing. The internal fittings consist of a number of porcelain cells, one for each cable core. Details of one of these cells are shown in fig. 2. Through the bottom of the cell pass two studs, one of which is in metallic contact with a bus-bar (*a*), and the other is directly connected with one of the cores of the cable. To these studs are attached two main contacts, *b b*, and these again are connected together by means of a removable link *c*. The porcelain cell is of a suitable depth to provide for the link being immersed in oil. Each cell is provided with a glass cover, and in the centre of

each link is a screwed hole into which the operating rod is screwed for the removal or insertion of a link. These cells are assembled in groups corresponding to the number of phases, and they are embedded in the box compound with which the greater portion of the cast-iron box is filled.

Referring to the cast-iron box itself, the bottom joint passes through the main cable glands, and the faces are machined and fitted throughout. This arrangement provides the maximum of accessibility, in that it allows of all the cable cores being set into position and jointed up before the box is finally assembled, and when this is done nothing remains but carefully to wipe the lead of the cable to the brass glands of the box.

The complete jointing of one of these boxes occupies too much time to permit of all the work being done at the site. Obviously the ring circuit would require to remain open all the time this work was being carried through, and that being so, the risk has to be taken of another section of the main opening under fault conditions, thus endangering supply to a more or less extensive area. This difficulty is got over by jointing into the link box short lengths of cable of the required sectional area. After assembly the box is transported *en bloc* to the required site, where two or more cable jointers make the requisite straight joints in the minimum of time.

These boxes are not intended to break load, but simply to disconnect a line under pressure. In one or two cases of emergency a connection has been both broken and made under load, but the carrying out of this operation demands a cool head and a steady hand, the flash and noise when the circuit is either made or broken under these conditions being considerable.

Special care has in all cases to be taken to eliminate any traces of moisture inside the box, and this is done by means of an exterior vessel containing calcium chloride. This vessel is directly connected with the box by means of a short piece of screwed tubing, so that the chemical can be renewed when required without the necessity of opening the box cover.

In the construction of the box chamber, every care must be taken to exclude surface or drainage water. The chamber therefore usually consists of a shallow pit built of 9-in. brickwork on a 6-in. bed of concrete, this brickwork being surrounded by a 4½-in. brick wall so placed as to leave a space of 1 in. or more between the two walls. This intervening space is filled with bitumen run in hot, and thus ensures a perfectly dry chamber under all climatic conditions. Care has also to be exercised to exclude moisture when opening the box, particularly in damp weather, this operation being carried out under a jointer's tent.

It has been found in practice to be quite feasible to take branch services off sections of cable controlled with balanced protective gear. At first sight it might appear that the taking off of such intermediate services would disturb the static balance in the current-transformer secondary circuits. Theoretically this is undoubtedly the case, but when it is borne in mind that in actual practice the relays employed in connection with a balanced protective system are usually set for operating on a fault current of from 60 to 200 amperes, it will at once be apparent that there is an ample margin within which it is possible to give a branch supply without materially impairing the efficiency of the protective system. Nevertheless, it has been found necessary to install a no-volt release at the supply or consumer's end of such service branches, as otherwise the static balance is liable to be disturbed in the event of any sudden fluctuation of voltage, caused, for example, by a fault on the external circuit.

Supplies given off these service branches are subject to the disadvantage that they are liable to temporary interruption if a fault should occur on that portion of the ring-main circuit off which the branch is tapped. This is, however, not a serious objection, as it is a simple matter to test out, disconnect the faulty section, and restore supply over the sound portion of the ring-main section. Obviously, it is in this connection that the disconnecting links are of special value.

It will be readily understood that in a widely scattered industrial area the field for such devices is fairly extensive. Branches are often extended from time to time for miles, continuing from one point of supply to another, until in the ultimate course of development it is found practicable to reconnect the far end either with another similar branch or with another point on the ring circuit, the branch ultimately becoming part of a subsidiary ring. The original box is then withdrawn and a switch-house substituted in its place. With development carried out in such a manner, it is possible to make each extension on a minimum of capital outlay, the supply network by a process of steady growth being extended over a wider area to the mutual advantage of the industrial community and the supply authority.

One of the chief sources of reliability is simplicity, and the author is a confessed advocate of the single-branch service as the most direct method of securing reasonable freedom from failure for all classes of supplies, except those the magnitude or importance of which makes inclusion on a ring circuit imperative. All such service branches should, in every case, be laid complete with the necessary auxiliary cables for a telephone service and pilot wires, so as to permit of the steady development of the branch in the direction already indicated.

It is, of course, not contended that these link boxes are applicable in every instance, but it is undoubtedly the case that their use makes it possible to secure business which would otherwise be most difficult to negotiate.

A demand sometimes arises for small lighting and power supplies for farms or residential property along the route of overhead transmission lines. There is a growing tendency to make the granting of wayleave facilities, especially through residential estates, conditional upon the giving of a lighting supply to the owner's house. Where such a condition has been imposed it can be very readily met in the case of a low-tension transmission line, but in the case of an extra-high-tension transmission the solution is not so simple. The author has met the difficulty by using small pole-type transformers. The reliability of transformers of this type has been fairly well established. No effort should be spared to create and develop a demand for electrical energy on the part of the small power consumer. No scheme of electrical power distribution may be considered complete which finds no place in it for the small trader or the ambitious workman who desires to become his own master. Only by such means can an appropriate place be found for electricity in the service of man.

Discussion.

Mr. Mitchell said he was in complete agreement with the author; the taking of branches off high-tension loops was now recognised as quite good practice. The N.E. Coast system did not use these junction boxes, but a large proportion of the system was on 20,000 volts, and junction boxes would not be so satisfactory at that pressure as they were at 11,000 volts. In Glasgow, following the Clyde Valley Co.'s lead, they had used these junction boxes for some years. They had eight working and another was being put in, and they gave complete satisfaction. They had not had to open these boxes in an emergency during the whole time they had had them in use. In the diagram shown in the paper the positions of the bus-bars were in proper sequence, but he thought the bus-bars on phases one and three should be kept always to the outside of the box for the sake of getting longer bends on the cores to the cable terminal contacts, which would then be towards the inside of the box. With regard to the identification of the bus-bars, he had thought of fixing a piece of porcelain to each bus-bar which would project up through the compound, and so identify the bar; they had not found assembling in a workshop a great success. They could put down a box with all the tails laid out in a country road, but in a crowded thoroughfare this was not possible. They had always to contend with gas and water pipes, and when all the tails were connected they might have to thread underneath these conduits, which subjected the cables to severe strains. He did not quite agree with the author with regard to the time lost in assembling a box *in situ*. It was not necessary to interfere with the loop until they had got the tails laid out; they had the tails which would ultimately connect the loop laid alongside the main cable, and after everything was connected up it was easy to shut down the loop section and make these two joints, and all the time during which the section was dead was that necessary for making the joints. With regard to the earthing of the cables at the box, he thought it was most desirable that facilities should be provided so that that could be done. Say that a fault existed on the branch leading from the box. The links would be drawn in the box on that cable, but the bus-bars would be kept alive. After the faults had been located it was likely that a joint or joints would require to be made, and it was then desirable that the faulty cable should be earthed if possible in the box, and at the other end also. The jointer's mind was at rest if he knew the cable was earthed at both ends. He showed a very simple and safe device which enabled this earth connection to be made in the box. This was done by substituting for the lid of each cell another lid of porcelain with a fitting attached which when the lid was placed in position made contact with the cable terminal contact. The fitting was connected on the outside of the lid by a length of insulated conductor to an earthing stud on the side of the box. The use of this device made the identification of the bus-bars all the more important. Also, the cable terminal contacts must be got at when identifying the phases preparatory to making the joints, and this would be a dangerous proceeding with the bus-bars alive unless the tester was absolutely clear as to the position of the live terminals. The use of this earthing connection enabled the phasing to be carried out in perfect safety. As to the advantages of the use of calcium chloride, his firm had not used that, and had not, so far, had any trouble through not using it. He asked whether the author had had any trouble due to the covers of the cells being made of glass. They had found a number of the glass lids broken, due to temperature change, when they had gone back to the boxes some time after they had been put in place. He thought that in future the glass lid might be replaced with a porcelain lid.

Mr. Wm. Nairn said that when he first learned, five years ago, that such boxes were in use he considered that their operation would cause the staff grave concern, but during that period not a single failure had occurred. The author had stated his opinion that "all disconnecting boxes should embody in their design their own diagram of connections." There was no doubt that this was a point of paramount importance, not only in the design of junction boxes, but also in the switchgear lay-outs in the sub-stations. Stonework partitions between feeders should differ considerably from the stonework partitions between the phases of the same feeder;

isolating links should be placed immediately over and under the oil switches they controlled; remote-control bodies should be arranged symmetrically opposite the oil switches, and generally the whole design should be arranged on its own diagram of connections, as the author pointed out.

The Chairman (Mr. D. A. Starr) said that in a diagram of Canadian transformers shown by Mr. Macleod, these were enclosed with housing around. He did not think there was any Board of Trade regulation which insisted on such enclosure. He had seen thousands of these transformers in Canada for pressures much higher than the 11,000 volts which was used by the Clyde Valley Co., and these transformers erected on poles had no cover or housing whatever.

Mr. J. K. Stothert recalled some experiences. In 1890 he had to do with laying mains for one or two towns; it was before the days of oil-immersed transformers. They put the transformers in street boxes, and had a good deal of trouble due to dampness. They got over a good deal of the difficulty by using receptables, and tried calcium chloride and caustic soda, ultimately preferring the latter. The heating of the transformers inside the box rendered it difficult to keep the joints intact, and the joints shown on the screen would never have done. They had to use thick flanges and good jointing material to keep the joints damp-proof. They put a special gauge inside to find out the pressure.

Mr. R. A. Brown asked the size of the pit and the containing box for these transformers.

Mr. H. T. Burton stated his conviction that the development of the H.T. service lay in the overhead link. When the inconsistencies both of our wayleave laws and out legislature were changed, the American system of lattice poles, overhead switching apparatus, and overhead transformers would be as common on our highways and railway lines as telephone lines were at present. Overhead transformers were in more common use in the South than in Scotland, and four years ago he supervised work on a 6,000-volt 50-K.V.A. transformer which was mounted on a four-membered pole without weather protection, and gave satisfactory service.

Mr. Macleod, in reply, said he would not like to put forward those boxes for use with 20,000 volts, though he had no doubt that it would be a comparatively easy matter to alter them to suit that pressure. He would adopt the apparatus Mr. Mitchell had brought forward in connection with his work. He had had no experience with the cracking of covers, and could only suggest that the two pieces of glass had been screwed up too tightly. As to the suggestion of the chairman that housing was unnecessary, his experience was that the white porcelain boxes proved too great a temptation to stone-throwing boys when left exposed. The protecting frame was 4 ft. square, and the box chamber was flush with the inside of the frame, the depth being 16 to 18 in. He would have no hestitation in putting in an equipment of pole switchgear provided he was satisfied on the point of design. His view of the Merz-Hunter protection as applied to overhead construction was that it was likely to cause more trouble than it would prevent. In the Merz-Hunter system, where they duplicated conductors they doubled their troubles by doubling their insulators. A common insulator was now being used to meet this objection.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Economy in the Use of Coal.

In your "Notes" of May 12th you refer to the letter issued by the Board of Trade to gas and electric lighting undertakings, calling for their assistance in reducing the household consumption of coal by 10 per cent.

Perhaps it has not occurred to the Board of Trade that a very considerable economy in fuel consumption can be effected by a general change-over from the use of gas to electrical energy for illuminating and power purposes.

The output of gas per ton of coal varies from 10,000 cu. ft. to 13,000 cu. ft., according to quality of coal and the retorts employed. A 66-C.P. burner will consume 4 cu. ft. of gas per hour, therefore one ton of coal will supply light, under the most favourable conditions of plant and fuel, to 3,250 66-C.P. burners.

By employing electricity as the lighting agent, under the best conditions of plant and fuel not more than 3 lb. of coal per unit of energy supplied need be consumed, therefore one ton of coal will produce 747 units of energy, or 747,000 watts, and 11,318 one-watt lamps of 66 C.P. each will give 3½ times the light obtainable from 3,250 66-C.P. gas burners; *i.e.*, by using gas for illuminating purposes 3½ tons of coal are used to every single ton necessary to produce an equivalent illumination by the use of electrical energy, by which 70 per cent. of fuel can be saved.

By using half-watt lamps the proportion of fuel consumed is one to seven.

But a greater field for economy presents itself in the use of power. 25 cu. ft. of gas per H.P. is a fairly moderate estimate for gas-engine consumption, compared with 746 watts by the use of electrical energy.

One ton of coal will yield 520 H.P.-hrs. by the use of gas and 1,000 H.P.-hrs. by the use of electricity, which shows a saving of approximately 50 per cent. in coal consumption.

Perhaps steps could be taken to bring these facts to the notice of the Board of Trade, with the assurance that every electrical engineer will readily assist the Government to bring about this enormous reduction in coal consumption provided the Government will assist the engineers in obtaining adequate supplies of fuel and machinery to achieve the desired object.

J. Horace Bowden,
Borough Electrical Engineer & Manager.

Electricity Works, Poplar, *May 16th*, 1916.

Faults in Bitumen Cables.

The opinion of others would be welcome on the following problem. About eight years ago three bitumen cables were drawn into a 3-in. earthenware duct, the conductors being .1 in., .1 in., .075 in. Voltage across outers 440 v., continuous current. The positive cables have given trouble, while the negatives have not. In one fault the bitumen had disappeared at the fault, on one side of the cable, for a distance of about 6 in., the copper being green and eaten through. The bitumen was in good condition in other parts, except that the braiding was gone in a few patches. The duct is damp, but not excessively so.

I will be glad to hear from others who have had similar faults as to whether trouble of this kind is liable to spread rapidly or whether it remains local. Also, if it is a good thing to change the polarity of the cables, so that the positive becomes negative and *vice versa*. Will such a change prolong the life of the cables, or will it bring their life to a sudden termination?

Bitumen.

Decimal Coinage.

Like all who have an eye on England's future I, too, am intensely interested in the decimal question. But why need Mr. C. Thorkelin bother further about the decimal money system? The problem has been solved for some considerable time by those far-seeing people the Esperantists. Their seven-year-old system (recognised by the London Chamber of Commerce) is based on the "Speso," an imaginary coin whose international value is .05s., 1,000 speso = 1 spesmilo, the practical unit; which is equivalent to 2s., 2m., 2½f., and so forth. The method of pricing catalogues, estimates, &c., is easy in the extreme. The contractor simply quotes in spesmilo or decimal fractions thereof, and that figure is comprehensive in all countries.

May I here offer a tip to engineers who are receiving or sending money abroad? Let them send it through the International Esperanto Bank (it is connected with a big London bank, by the way), and their *bureau de change* losses will go down rapidly. This is not intended as a free advertisement for the bank in question, but a frank exposition of personal experience.

Herewith is enclosed a money table issued by the bank, giving the relative values of the spesmilo to various units of monetary systems throughout the world.

I give this information for what it is worth, and hope that others may taste of the benefits which I myself have enjoyed for several years.

I would gladly give inquirers any information or addresses of firms abroad who I know use the system.

Alfred Bridges.

20, Wilsons Road, Hammersmith,
London, W., *May 20th*, 1916.

[It is interesting to note that the unit adopted by the Esperantists corresponds with that which we have recommended in preference to the franc or mark, namely, 2s., one-tenth of £1.—Eds. Elec. Rev.]

WAR ITEMS.

Exemption Applications.—At Middleton, an electrician appealed for the exemption of two wiremen. One—an apprentice with a mother and sister partially dependent on him—also appealed on domestic grounds, but he was ordered to report. The other man was granted exemption conditional on his remaining in his present occupation.

At Ramsbottom (Lancs.), on May 18th, an appeal was made for a tramway depôt foreman, and it was stated that he had been employed at the depôt since the local tramway system was commenced. The cars would stop altogether, it was stated, if this man had to go. Exemption till August 1st was granted.

At Chipping Norton, the Recruiting Officer applied for the withdrawal of certificates of exemption held by Mr. W. H. Hellyar (37), manager of the local electricity works, granted under Regulation 48, sec. 6, para. 2B, and Geo. G. Bates (21),

electrical worker with the electricity company. Asked how many men were employed before the war, Mr. Hellyar replied that the number varied from seven or eight down to five. He now had only one other man of experience with Bates, two apprentices, and a Belgian, who assisted. There should be at least two on each shift, but he was now running with only one. There was a lot of mains work he had not been able to touch; in fact, there was work in this respect to occupy two or three months. He was now working with the minimum staff to maintain the private supply of light, and he himself was doing the mains work besides his own. The Tribunal allowed Mr. Hellyar's certificate to remain, but granted the appeal as to Mr. Bates.

Kingston-on-Thames Tribunal has granted exemption until August 31st to the head of the electrical department of W. H. Gaze & Sons, Ltd., who is largely engaged in carrying out installations at various munitions factories.

Margate Tribunal has refused any exemption to a local electrician who claimed to be in a certified occupation.

At Newton Abbot, the Urban Electric Supply Co. applied for exemption for a stoker as being in a certified occupation. The manager said it was impossible to get another man in his place. On a month only being granted, the manager said he should appeal to the County Tribunal.

At Canterbury, Mr. H. E. Philpot, electrical engineer, applied for absolute exemption, and he was given a conditional certificate. He also applied for a wireman, Alfred Fassum, who is engaged on important electrical installations for the Government. Mr. Philpot said that he himself and Fassum had been scheduled for badges, but some delay had occurred in obtaining them. This case was deferred for a month in view of the badges arriving.

At Exeter, on May 16th, Wippell Bros. & Row, engineers, of High Street, appealed for A. E. Wilson, the only qualified electrician left with the firm. Out of the staff of 27, 15 have gone. Exemption was allowed until July 31st.

At Sutton (Surrey), an electrical engineer appealed for his 19-year-old apprentice, whose indentures expire on September 30th, and whose services he desired to retain in order to be able to complete contract work, eight employés having enlisted. The appeal failed.

Beddington and Wallington Tribunal has granted a local electrical engineer, aged 36, exemption until August 31st.

Nuneaton Corporation electricity department appealed for seven members of the staff. Three were temporarily exempted until September 30th; the others were given conditional exemption.

At Oxford, the Electric Light Co. appealed for exemption for Wm. Chas. Coates (26), stoker at the generating station for the public supply of electricity. It was stated that 16 out of the engineering staff of 40 had enlisted. Conditional exemption as being in a certified occupation was granted.

Messrs. Webster & Sons, electricians, Folkestone, have appealed for H. J. Vine, the only engineer left besides the foreman. Four months' conditional exemption was conceded.

Mr. J. W. Darby, an engineer at the Caterham electricity works, has been given conditional exemption. It was stated by the manager, Mr. Howard, that there were only two engineers to work the night and day shifts.

At Torquay, on May 16th, Mr. Nisbett, manager of the Tramway Co., appealed for the chief clerk of the traffic department and an electrical fitter. The latter, it was stated, had been taken away once and placed in Devonport Dockyard, but he was released on an appeal being made. The chief clerk was exempted until September 1st, and the fitter was given conditional exemption.

At the Hastings Tribunal an electric wireman and general electric repairer and an ironmonger's manager were claimed by their employer, who stated that he had tried at the Labour Exchange for other men; over 20, or more than half, of the staff had joined the Colours. The case of the wireman was adjourned for him to be medically examined, and the other was given two months' exemption.

At the Blackpool Tribunal, on May 18th, a discussion took place regarding the employment of four young single men at Blackpool Corporation electricity works. Mr. Dunkerley said Mr. Furness, the borough electrical engineer, had made a statement to him about the men, and had explained that an Inspector from the Ministry of Munitions had been down and made application for badges for them. It was practically certain they would get them, but they had not received them yet. It was decided to ask Mr. Furness to attend and make an explanation at the next meeting of the Tribunal.

At Chatham, on May 16th, the Chatham & District Tramways Co. applied for the exemption of three switchboard attendants and a car fitter. One switchboard attendant was given three months; the other claims were rejected.

Mr. Frank Bailey, electrician, in the employ of the Burnham (Somerset) Electric Supply Co., Ltd., has been given total exemption.

Before the North Devon Appeal Tribunal, on May 17th, Garnish & Lemon, of Barnstable, appealed for C. W. Cockram, electrician. It was stated that a war-serving badge had been obtained, but not yet received. It was claimed that the man was now under the Ministry of Munitions, and beyond the jurisdiction of the Tribunal. The case was adjourned *sine die* provided the badge is received.

The Middlesbrough Tribunal has refused exemption to Wilfrid Heal, electrician at the Grand Opera House, who pleaded that he had a wife, two children, a blind father and crippled mother dependent upon him.

At Oldham, an electrical engineer sought exemption for an electrician and wireman. Prior to the war 10 men were employed, and now there were three only, one of whom was over military age, and another had to report for service in July. Exemption until August was granted on business and domestic grounds. The same Tribunal granted exemption till July 1st to an electrical engineer and contractor with a partner. He urged that his business premises would have to be temporarily closed if he had to go. The employés of the firm had gone into the Army.

At the Walsall Tribunal, on Friday, an electrical instrument maker who applied for exemption, explained that he was engaged in making electrical instruments required by the Government. Before the war 75 per cent. of these instruments were made in Germany. His partner knew nothing about the electrical part of the business, and if he (applicant) had to go it would have to close down. In reply to questions, applicant said there was only one other firm engaged in making these particular instruments. Six months' exemption was granted, and the Chairman of the Tribunal observed that it was a trade which ought to be developed.

At Barnstaple, on May 17th, Mr. Frank Bickford, electrical engineer, applying for exemption, stated that he was responsible for the upkeep of over 140 H.P. motors at various factories, his business was solely dependent on his own energies, and the major portion of his capital was in the stock, while he had an extensive fitting business. The Military did not assent, on the ground that there were other electricians available in the town. It was decided that Mr. Bickford, who had been passed by a local doctor for garrison duty only, should be re-examined by the Army Medical Board.

At Rawtenstall, last week, an appeal was made by Mr. Stewart, tramways manager, for the exemption of a switchboard attendant who was unbadged. It was stated that 26 men, some in responsible positions, had left. A badge for this man had not been applied for, because it was thought he was under military age. He was in his present occupation before August last year. The appeal was allowed.

At the Grantown Tribunal, Mr. G. Anderson asked for the exemption of an electrician. Applicant had the contract for the lighting of the town, and the engineer had left with the Territorials at the outbreak of the war.

At the Kingston Tribunal, Messrs. Offer & Sons asked for the exemption of their works foreman, who had charge of all the electrical machinery, and was responsible for setting out the joinery work. He was practically the key of the shop. Exemption granted to August 31st.

At the Aldershot Tribunal, Mr. Vertue, electrical engineer, appealed on his own behalf on the ground that if his men were taken he could not carry on the business. His partner was wholly engaged under the Officer-in-Charge, Electric Light, Aldershot Command, and he could not receive any help from him. Applicant was granted exemption until August 15th. Mr. Vertue also applied on behalf of an employé, aged 32 years, Group 37, electric wireman and fitter, on the ground that if he were taken they could not carry on the business. They were the only firm of electrical engineers in the town, and were responsible to most of the biggest firms in the town engaged on Government work. Exemption until June 15th.

An appeal was made at Drolysden by Messrs. Ashworth and Hadwen for their assistant electrical engineer, Mr. F. Hargreaves. He was allowed until May 31st only.

At Winchester, a firm of electrical engineers appealed for the only wireman left, who does nothing but electrical work. Six months was granted.

A Surbiton electrical engineer who appealed for his apprentice, aged 19, said that he had lost all his men, and it was impossible to replace them owing to the high wages obtained in munition works. No exemption was allowed.

At Southwark, on Tuesday, Samuel Vousdon, of Ryan and Vousdon, porcelain and stoneware electrical insulator manufacturers, applied for exemption. He was an ironmonger's assistant before the war, but since the war began had started this business with his brother-in-law. The articles which he produced were made entirely in Germany before the war, and since they commenced business they had been inundated with orders for Government departments and private works. He was granted conditional exemption.

Substitutes in Germany.—The annual meeting of the Verein Deutscher Elektrotechniker, which is to be held at Frankfort-am-Main early next month, is to be mainly devoted to papers on the subject of "Substitutes for Scarce Electrical Engineering Materials, and on Experiences with such Substitutes." In connection with the gathering, an effort is being made to organise an exhibition of all the substitutes that have been brought into use since the commencement of the war, and in order to make it as complete as possible a general invitation to send specimens has been issued to all German electrical engineers.

Dr. Rathenau.—On May 20th the "Times" mentioned the prospect of Dr. Rathenau, of the A.E.G., of Berlin, becoming Minister of Finance in place of Dr. Helfferich, but an Amsterdam report of the following day gives that appointment to Count von Roedern.

Controlled Works.—The number of works now controlled by the Ministry of Munitions is 3,577.

After-the-War Trade.—The "Times" states that the Council of the Association of Chambers of Commerce have passed a resolution expressing the opinion that the Board of Trade Committee on Textile Industries after the war is not sufficiently representative of the large producers.

It is stated that the President of the Board of Trade has appointed Mr. Henry Summers to be an additional member of the Committee recently appointed to consider the position after the war of the iron, steel, and engineering trades.

In the House of Commons Mr. Asquith said that according to his information he could not accept as proved the statement that quantities of goods were being made and stored in Germany and America for the purpose of being dumped in the United Kingdom at the end of the war. The Government's expert advisers failed to find any evidence of this. The question of trade policy after the war was receiving, and would continue to receive, the most careful consideration of the Government.—In reply to Mr. Hunt, who asked: "Can we have any assurance that millions of our own people will not be driven back to the starvation wages of pre-war days?" Mr. Asquith replied: "How can I give such an assurance?" To a later question by Mr. Hunt, asking for an assurance that we should have fair play in our own country and in the Colonies, the Press reports "No answer was given."

Speaking in the House of Commons, in the course of the debate on the second reading of the Finance Bill, Mr. Chamberlain said (according to the *Times* report) we were using up capital for the purposes of the war at a time when neutral countries, happily for themselves saved from the struggle, were making enormous profits at the expense of the belligerents, and were able out of their profits to reorganise, extend, and develop their business. He would not undertake to say what was the exact measure of agreement which might be evolved among the various parties as we set ourselves to the work of reconstruction after the war. He would be a rash man who would undertake to say what were the limits of possible agreement. But one thing was clear—we could not leave the work of reconstruction to chance. There was no section which would maintain that we could pursue after out experience of this war the policy of *laissez faire, laisser aller*. It was common ground among people who were widely divided in the old days that the Government must come in to help, organise, and support, to see that the pivotal industries of the country were to continue to exist, and that industries which were vital, as we had found out, to the country, should not again be allowed to be crushed out, but should be maintained at least in so far as any one of them could be shown to be necessary to the full life and vital strength of the nation. Speaking for himself, he was not at a time like this or in the future going to consider himself bound to the exact measures which he advocated before the war, nor even to a rigid policy which in the circumstances after the war he might not consider the best. It would be a much better thing to get a system which any one of them might regard as imperfect, but which might really form the basis of a national and Imperial policy for our political development hereafter. Any declaration of policy by the Government had better be made at the Paris Conference rather than now, before they had consulted with their Allies, or had their proposals before them. The representatives of the Government at that Conference would go there unbound by any rigid school of economic thought of the one kind or the other—unbound by any specific fiscal policy which they had adopted in this country in the past or which some of them had advocated, in order to see in what way their common interests might be best pursued and strengthened.

Prohibited Exports.—A supplement to the "Board of Trade Journal" for May 18th, which occupies over 100 pages, and is, therefore, larger than the normal issue of the "Journal" itself, brings together in convenient form the complete "Prohibitions of Export in Force in the United Kingdom and in Certain Allied and Neutral Countries." Export firms should find it of considerable assistance to them.

To be Wound Up.—The Board of Trade has ordered to be wound up, under the Trading with the Enemy Amendment Act:—

Isaria, Ltd., 208, Tower Bridge Road, London, S.E.—Dealers in electric meters, &c. Controller: G. S. Pitt, 140, Leadenhall Street, E.C.

Trading With the Enemy.—The "London Gazette" for May 19th contains further additions to the list of persons or bodies with whom trading is prohibited in Argentina, Brazil, Chile, Netherlands East Indies, Norway, Persia, Peru, and other countries.

Rhodes Scholarships.—It is announced that the trustees of the will of Cecil Rhodes intend to apply for a Bill in Parliament abolishing the Rhodes Scholarships at Oxford allotted to German subjects.

THE ELECTRICITY SUPPLY OF GREAT BRITAIN.

In his reply to the discussion in London on his paper, read before the Institution of Electrical Engineers (reported in the Electrical Review of April 21st, p. 447), Mr. E. T. Williams, referring to Mr. Merz's remarks, said he thought the chief reasons why they had not made greater progress towards the ideal in electricity supply were that they had not considered the problem from the standpoint of the country as a whole, and had lacked a central organisation to translate theory into practice and co-ordinate effort. He was convinced that centralisation of plant was the ideal arrangement, and must come sooner or later. Mr. Merz's splendid achievements on the North-East Coast showed something of the possibilities of public electricity supply and the soundness of interconnected power stations with large units, enabling a saving in fuel of 30 to 60 per cent. to be effected. He had come to the conclusion that it was the basis of organisation that required solution, and they should not go to Parliament until they had secured the support of the electrical profession in general and the electricity supply industries in particular. Their densely populated manufacturing districts required large power stations at comparatively short distances apart, rendering interconnection easy and inexpensive; no district in the world, taken as a whole, offered so favourable a field for a cheap and efficient electricity supply, and the remarkable load factor attained on the North-East Coast was due to the interconnection of the stations in that area. In reply to Mr. Chattock, he did not agree with the nationalisation of electricity supply, knowing the disabilities under which Government departments worked. Small economies often meant the difference between success and failure, and it was fallacious to suppose that because a manufacturer's costs for power were only 1 per cent. of the total costs, it was of no importance to reduce the price of energy by 10 per cent. They should be independent of State finance; the proposed Electricity Board should raise money on the security of its assets for the erection of power stations, &c., and would work on a commercial footing, paying interest and sinking fund, but not operating for profit. Mr. Chattock's proposal to replace small stations by a bulk supply at once would raise powerful opposition to the scheme. Powers to grant wayleaves to electrical undertakers should be entrusted to the Board. If they could go to Parliament as a united profession, backed by municipalities and electricity supply companies, with a sound, straightforward proposal, he believed it would soon become law. In answer to Mr. Highfield, he had no intention of proposing to sacrifice the vested interests of either capitalists or engineers. By cheapening the cost of electricity, not only the public, but also the capitalist and engineer, would be benefited. In view of the difficulties incurred, their past achievements were truly remarkable, but the position of the industry was far from what it might be, as exemplified by the success of the North-East Coast system. If they could be sure that the requirements of the country could be met without the Board having operating powers, he would agree that it should be only a controlling board; and if this question of dual powers became an obstacle to agreement, it would be better to give way on the operating question for the sake of unity, and carry through the proposal for an electricity board with controlling powers only. But he believed the interests of present undertakers could be properly safeguarded in the Act of Parliament by which the Board would be created, and the Board could be prevented from operating in competition with any existing undertaking in that undertaker's area; if an undertaking misused its powers the Board could refer the matter to Parliament. If the Board had no operating powers it might mean a serious loss to present undertakers, as well as to agricultural districts which undertakers would not care to supply; moreover, the Board would be unable to carry out pioneer work in the direction of gas-fired boilers, recovery of by-products, &c. Parliamentary control would be ensured by the presence of a Member of Parliament on the Board, who would have to answer for the Board in Parliament; a Government official might possibly be added to the Board as a further link with Parliament. Mr. H. Faraday Proctor's energetic demand to "get a move on" was backed by a large number of electrical engineers. There was a call for action, and the sooner they made their demands known, the sooner the new era would commence. They should avoid widening the scope of the inquiry, and keep out any proposal with the word "Ministry" in it. He agreed with Mr. Wordingham that it was important to avoid Government operation in electricity supply; but Parliament would never put extensive powers into the hands of any other organisation than a Government department or a Public Board such as that which he proposed. He was absolutely opposed to anything that would deal unfairly with existing concerns. With regard to Mr. Roles's remarks, he had great sympathy with the interests that he mentioned, and knew it was useless to bring forward a scheme which could not be supported by electrical engineers while remaining loyal to their own interests. But he was satisfied that with extended areas for distribution and an increased demand due to lower costs, the importance of their undertakings would be much greater than at present, and the positions of the engineers would be strengthened and improved. He welcomed Mr. Roles's suggestion of endeavouring to bring into the scheme the smaller stations which would not form part of

the ultimate scheme, in order to avoid the opposition of the engineers and committees or companies controlling them. The new electricity supply era would create such a large demand that consulting and supply engineers, manufacturers, and all connected with the electrical industry would find more openings, the engineers' status would improve, and their services would be at a premium. This home demand would react favourably on exports. On the other hand, if united action were not taken, after the war capital would not be attracted to extend electrical operations, and the electrical industries would be badly affected. The more efficiently and economically they organised the sooner the period of trade depression would be over. The Institution and the technical Press could render the greatest assistance by creating interest in the subject and focusing attention on the main issues, and the engineers of medium and small undertakings could educate their councils to advocate the proposed organisation. The trend of the discussion appeared to be favourable to a scheme on the basis of: interconnection of power stations for security of supply; reduction of costs; conservation of fuel; and co-ordination of control, and the opportunity had arisen to advance a cause of great national importance.

Replying to the discussion at Manchester (reported in the ELECTRICAL REVIEW of May 19th, p. 575), Mr. WILLIAMS pointed out that Mr. Robertson was mistaken in supposing that the proposed bulk supply system would be owned and operated by the State through a Central Board; the country was to be divided into six districts not for supply purposes, but for the purpose of control, an entirely different matter, and it was not proposed to place the control of any one of the districts in the hands of one engineer manager—the control would come under the Board as a whole. The engineer would manage only the property of the Board in his district, and not that of municipalities or companies. Any person, company, or body in the district could present its case directly to the Board if desired. The smaller generating plant would not be superseded until it had fulfilled its economic purpose—that is, until the cost of a bulk supply was less than that of running the plant and meeting the standing charges on it. The Board could withhold its approval for extensions or replacement of obsolete plant, where such a course would not be advantageous, but could not otherwise control the price charged for energy by local authorities or compel them to shut down existing stations. Contrary to Mr. Robertson's view, he held that this was the best possible time to deal with the problem. He welcomed Mr. Robertson's proposal to form subsidiary Boards, but urged the necessity of forming the Central Board first. In reply to Mr. Highfield, he thought it desirable that at no distant date municipalities which possessed powers to purchase the undertakings of companies should be called upon to adopt settled policies, so that there should be no period of uncertainty of tenure. The Board would probably discourage the taking-over of companies' powers by municipalities so long as a cheap supply of electricity was ensured. He did not agree with Ald. Walker that the cost of site was immaterial; no item of cost was immaterial. In reply to Mr. E. K. Scott, the members of the Board would be paid, and would be expected to devote the whole of their time to the work of the Board. If, as Mr. Roles suggested, the Home Office, Board of Trade, or Local Government Board opposed the scheme, the opposition would have to be met, and if it were insuperable he thought they ought to proceed with the Board with whatever powers they could obtain for it, and expand its powers later. He had had the subject of the paper under consideration for many years, and held that the inclusion of the many subsidiary matters touched upon in the discussion would create controversy and delay achievement. They should keep in mind the main issues, and deal with the subject in a businesslike manner. The agreement that something should be done somewhat on the lines suggested was more general than he had anticipated, and the profession would welcome energetic action on the part of the Council of the Institution.

BUSINESS NOTES.

Liquidations. — *Re* CEDES ELECTRIC TRACTION CO., LTD., 112, Great Portland Street, W.—The creditors and shareholders of this company (in liquidation) met on May 19th, at the Board of Trade Offices, Carey Street, W.C., when a statement of affairs was presented showing unsecured liabilities £44,826 and assets valued at £3,992, after deducting £4,000 to meet the claims of the debenture-holders. The deficiency as regards shareholders is estimated at £47,834. Mr. H. E. Burgess, Official Receiver, reported that the company was formed in 1910, most of the issued capital being held by the Austrian Daimler Motor Co., of Vienna. In 1911 an agreement was entered into, under which, in consideration of certain royalties, the Austrian company granted to this company the sole right to manufacture and sell their electrically-driven motor vehicles. In 1914 the financial position of the company became somewhat difficult, and an arrangement made for it and another business to be taken over by a new company was rendered abortive by the war. The company's business had been carried on at a loss throughout: in 1913 the books showed a loss of £7,000, in 1914 it was £7,395, and in 1915 it amounted to £14,000. The directors attributed the failure of the company to the fact that its resources were too limited to produce on a scale sufficiently large to be remunerative, but, the chairman added, there also appeared to have been some discord between the management in London and that in Vienna. A Receiver had been appointed on behalf of the debenture-holders, and the whole of the assets were in possession of that gentleman. The liquidation was left in the hands of the Official Receiver. Appended is a list of the principal unsecured creditors:—

Lancashire Brass Foundry ..	£30	Electro-Mechanical Brake Co., Ltd.	£23
Berham, T.	22	C. Churchill & Co., Ltd. ..	25
Dunlop Rubber Co.	105	Tramway and Railway World Publishing Co. ..	72
"Fi e"	36	Direction der Disconto Gesellschaft	39,231
Tudor Accumulator Co., Ltd...	159	Austrian Daimler Motor Co., Ltd.	2,589
Schenker & Co.	15	J. Sandell & Co.	16
Geo. Adams	19	British Insulated & Helsby Cables, Ltd.	48
Turner & Co.	13	W. P. Thompson	14
Marryatt & Place	16	Johnson & Phillips, Ltd. ..	750
The Electric Vehicle	12	J. Sankey & Co., Ltd. ..	102
,, London Electric Wire Co.	44	Cooper Bros. & Co. ..	97
Pickfords, Ltd.	12	Graham, Nicholson and Jones	91
T. Chatwin, Ltd.	17	Stamford Hill Palace Co., Ltd.	75
C. Macintosh & Co., Ltd. ..	21	North Metropolitan Electric Supply Co.	56
Hart Accumulator Co., Ltd ...	158		
Boynton, Dowsett & Co. ..	25		
Vickers, Ltd.	18		
C. W. Burton, Griffiths & Co., Ltd.	87		
Sachsenwerk Licht und Kraft A.G., Dresden	40		
Christopher Dodson, Ltd. ..	537		

GENERAL ELECTROLYTIC PARENT CO., LTD.—A meeting is called for June 20th, at Widnes, to hear an account of the winding up from the liquidator.

ACCESSORIES MANUFACTURING CO., LTD.—A meeting is to be held on June 30th, at 8, Queen Street, E.C., to hear an account of winding up from the liquidator, Mr. H. A. McCann.

UNIVERSAL CHEAP CABLES, LTD.—This company is winding up voluntarily with Mr. H. E. Oldham, 30, Bush Lane, E.C., as liquidator. Creditors must send particulars by June 20th.

M. & G. TRUCK AND ENGINEERING CO., LTD.—Creditors should send the usual particulars to the liquidator, Mr. C. Cooper, 30, Moorgate Street, E.C., by June 20th.

Bankruptcy Proceedings.—A. F. HAWDON, electrical engineer, Gosforth.—June 5th is the last day for sending proofs for dividend to Mr. C. Woollett, Official Receiver, 30, Mosley Street, Newcastle-on-Tyne.

STEEL BROS, electricians, &c., late of 206, East India Dock Road, E.—A sitting of the London Bankruptcy Court was appointed to be held on Tuesday before Mr. Registrar Linklater for this public examination. An order of adjudication had been made on May 8th, against Sidney Steel, trading as, or a partner in, the firm of Steel Bros. Mr. Egerton S. Grey, Official Receiver, reported that inquiries were proceedings with a view to ascertaining exactly who constituted the firm. The examination was adjourned.

Book Notices.—"Annales des Postes, Télégraphes et Téléphones." Vol. 5. No. 1. March, 1916. Paris: A. Dumas. Price 12 fr.

"Pole and Tower Lines for Electric Power Transmission." By R. D. Coombs. London: Hill Publishing Co. Price 10s. 6d. net.

THE BRADSTREET CO., of London, E.C., have issued a pamphlet giving a summary of the failures in the United States and Canada in 1915, in comparison with those of previous years.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXV. No. 5. May, 1916. New York: The Institute. Price $1.

"The Principles of Apprentice Training." By A. P. M. Fleming and J. G. Pearce. London: Longmans, Green & Co. Price 3s. 6d. net.

Trade Announcements.—MESSRS. IKIN & EADS, LTD., announce that owing to the demand for their Quead electric fires, they have formed a separate company to control their electric heating department, which will be known in future as Quead, Ltd., 47-57, Marylebone Lane, London, W. Telephone: "Mayfair 3582."

Catalogues and Lists.—MESSRS. SCHOLEY & CO., LTD., 56, Victoria Street, London, S.W.—20-page illustrated pamphlet entitled "The Economical Production of Steam," and giving an account of the principal features of the Taylor mechanical stoker and the Copes feed-water regulator.

THE STENTOR ELECTRIC MANUFACTURING CO. (INC.), New York.—12-page pamphlet containing an illustrated description of the Stentor loud-speaking telephone equipment.

Private Arrangements.—B. T. GARDNER & CO., LTD., electrical engineers, 20, Bennett Street, Blackfriars.—A meeting of creditors was held on Monday, at Balfour House, E.C. The company had passed resolutions in favour of voluntary liquidation, and had appointed Mr. G. E. Corfield to act as liquidator. The statement of affairs presented showed liabilities of £199, and net assets of £22, or a deficiency of £177. Mr. Osborne stated that the company was formed a few years ago to take over the business which had previously been carried on by Mr. B. T. Gardner. A balance-sheet prepared in December, 1915, showed a loss on trading of £186. The business had since been continued, and further losses made. It was decided to confirm the liquidation of the company with Mr. Corfield as liquidator.

LIGHTING AND POWER NOTES.

Argentina.—The electric power station and the public water supply service of the town of 25 de Mayo (Province of Buenos Aires) have been acquired by the Compania Americana de Luz y Traccion of Buenos Aires, whose president is Senor Juan Carosio.—*Review of the River Plate.*

Bury.—Price Increase.—It is proposed to increase the price of electric current for private and public lighting, and tramways by a further 5 per cent., and for power and heating by 10 per cent.

Canterbury.—Price Increase.—The T.C. has decided to advance the price of current for lighting by ½d. per unit. This is on account of the Daylight Saving Act. It is computed that the extra halfpenny will convert a prospective deficit of £200 into the customary profit of £600.

Continental.—Italy.—"The Utilisation of Hydraulic Power in Italy" was recently the theme of an interesting address by engineer Del Buono, before the Associazione Elettrotecnica Italiana. In the view of the speaker, a new era is opening for Italy in this direction. Modern history had its start with the use of steam, and this occurred in countries rich in coal, whence their greater progress. Water-generated power had, however, many advantages, and estimates gave from 3 to 4 million H.P. as the Italian total available. This consumption might be considerably increased by the use of power by intermittent industries. The aggregate power of the installations actually at work was about 1 million H.P., and the equipments might be truly described as technically perfect. The problem of the transmission of energy to a distance, so far as Italy was concerned, might also be said to be completely solved in practice, it now being possible to transmit energy to a distance of from 400 to 500 km. But the utilisation of Italian power stations was far from being complete, so long as the plants were not used to their full capacity, and for the whole of the day—defects which might be remedied, on the one hand, by the use of storage reservoirs, and, on the other, by the creation of industries to utilise the surplus energy.

The extension of hydro-electric plants did not imply the elimination of the use of coal (of which some 10 million tons were imported yearly) for heating purposes, for which it was generally more suitable than electrical energy; but it was desirable to restrict its use as far as possible, as also to cultivate the national reserves of coal.

Of Italy's production of upwards of 1,600,000 H.P. of motive power, 40 per cent. was thermal in origin, but might be displaced by hydro-electric power, involving an appreciable saving in cost. The development of electric traction had hardly begun, some 348 km. only of the 16,000 km. in operation being electrified. The realisation of the Government scheme for the electrification of 2,000 km. more would call for about 300,000 H.P. Electric traction should also have a large development in connection with light railways and tramways. Furthermore, the electrochemical and metallurgical industries claimed attention with regard to the production of metal and the fixation of atmospheric nitrogen; the former as the base of all industry, and the latter as valuable for the development, in general, of agriculture, and, in particular, the intense cultivation of grain. An additional ¼ million H.P. employed would give such life to the iron, brass and zinc industries as to render Italy independent of the foreigner, while providing nitrates in the quantity needed by Italian agriculture.—*L'Elettrotecnica.*

At a recent meeting in Turin an influential Committee was formed to foster the movement in favour of the utilisation of the water power available in the Province of Piedmont, in connection with the supply of electrical energy for lighting and power purposes.

Croydon.—Price Increase.—The T.C. has decided to add 10 per cent. to all accounts for lighting, heating and power supplies, as and from the June meter readings. A similar percentage is to be added to the public lighting account, and the tramways will be charged an increase of ¾d. per unit on all units above 10 millions. The Electricity Committee reported that, having regard to the loss (£3,600) on the past year's working of the undertaking, it had no alternative but to recommend the increase. Part of the loss, however, had been made up by the tramway department, thus reducing the loss on the year to approximately £800. There would probably be an increase of £6,000 in the cost of coal and materials during the current year, so that unless the charges were revised, there would be a large deficit at the end of the 12 months.

Dublin.—Damaged Arc Lamps.—At a meeting of the Electricity Supply Committee details were submitted of the damage caused to the arc lighting system during the recent insurrectionary troubles. Most of the damage was done, apparently, by rifle fire, and in the majority of instances the lamps were beyond repair. The total cost of making good this class of damage was estimated at £1,050. It was reported that the electric lighting accounts of consumers whose premises had been destroyed by fire amounted, for the past 12 months, to £8,072. A letter was read from the B. of T. asking that a notification be issued to consumers urging the necessity of economy in the use of electric light, as a reduction of the coal supply to the generating station at the Pigeon House might have to be made.

Fleetwood.—The Blackpool Building Trades Employers' Association has written to the Electricity Committee respecting the carrying out of private work by the employés in the electricity department. The Committee has decided to take no action in the matter.

Heston and Isleworth.—Suggested Price Increase.—The L.G.B. auditor in his report upon the electricity undertaking, states that the year's working, after allowing for all charges has resulted in a deficiency of £1,050, which, with £938 brought forward from the previous year, makes a total deficiency, at March 31st, 1916, of £1,988. The electrical engineer reported on the question of enforcing the minimum legal charge. The minimum statutory charge the Council was entitled to was 13s. 4d. per quarter, *i.e.*, 20 units at 8d. Last year they had 70 accounts under 6s. each. In view of a further decrease in the use of current consequent on the Daylight Saving scheme, the losses in revenue were likely to increase, and he suggested an entire revision of prices.

Heywood.—Year's Working.—There was a loss of £1,052 on the working of the Corporation electricity undertaking during the past year, including £112 disallowed by the L.G.B. some time ago. In the previous year there was a loss of £972.

Hornsey.—In the course of a report upon the question of a reduction in the quantity of electricity now being consumed in the darkened street lamps, the borough engineer stated, as regards arc lamps, of which there are 58, that the provision of small side-arm lights for post-midnight hours had enabled the arcs to be dispensed with. They used only 36 pairs of side-lights, in which the consumption of current per lamp had been reduced by one-half. The present cost of current consumed was £55 a year, as compared with £903 under normal conditions.

Hull.—Female Meter Readers.—The Corporation Electricity Committee has decided, on account of the depletion of the meter staff, to engage women meter readers at the same wages as paid to the men.

India.—On April 8th the Simla municipality took over the new generating plant. On the evening of the 19th the demand on the power station bus-bars was very nearly equal to the full installed capacity of the old plant, *i.e.*, 790 K.V.A.—*Indian Engineering.*

Keighley.—Revised Discounts.—The Electricity Committee has recommended the laying of a cable to the new hospital at Morton Banks, at a cost of £475. It is also proposed that as from April 1st the discount on accounts for electricity supplied otherwise than under sealed agreement be reduced from 5 to 2½ per cent.

London.—Bethnal Green.—The B.C. has decided to appoint Mr. H. W. Couzens as consulting engineer for its electricity undertaking until March, 1920, at an annual fee of 200 guineas plus 5 per cent. on capital expenditure.

Islington.—The B.C. proposes to apply to the L.C.C. for sanction to the borrowing of a further sum of £1,500 to cover the additional cost of mains, which was estimated in May, 1914, at £7,564, and subsequently revised at £9,076 in July last.

The City Corporation has been informed that the B. of T. has refused the application of the Charing Cross E. S. Co. for an increase in its charges for electricity of 10 per cent.

Rawtenstall.—Proposed Linking-Up Scheme.—At the meeting of the T.C. last week the borough electrical engineer reported that a scheme was being considered for linking up, where possible, the electric power stations in the Lancashire area with a view to economy and the placing of local authorities in a better position as regards electricity supply.

The T.C. has approved of draft agreement for the supply of electricity to Haslingden.

Ripon.—Proposed E.L. Scheme.—A movement has been started to form a syndicate for the supply of electric light to the city, and it has been decided to approach the Corporation to obtain its support in an application for lighting powers.

At the inaugural meeting Mr. Charles Pullan, of Bradford, explained a scheme pointing out that if the project was to materialise by the autumn of 1918, a move must be made now.

Mr. F. Stockton Gowland remarked upon the difficulty of raising the required capital locally.

Rochdale.—The dispute between Tyre Yarns, Ltd., and the Electricity Committee as to the interpretation of certain parts of the agreement between the two respecting the supply of current to the mills of Tyre Yarns, was again before the Committee last week. The firm has asked that the matter be referred to arbitration by the B. of T., and the Works Sub-Committee is to report on the request.

With reference to the proposal to borrow £10,000 for electricity works extensions, a deputation has been appointed by the Committee to interview officials of the L.G.B. on the matter.

Tottenham.—The North Metropolitan Electric Power Supply Co. is prepared to make an allowance to the U.D.C. of £139 in respect of public lamps not used during the past quarter. The General Purposes Committee is to ascertain whether this includes an allowance for the December quarter last.

Tynemouth.—The Electricity Committee has decided to adopt the revised wiring rules of the Institution of Electrical Engineers, and to request the local wiring contractors to conform thereto in future.

West Ham.—Loan Sanction.—The L.G.B. has sanctioned the borrowing by the Corporation of the following amounts for the purposes of the electricity undertaking:—£3,000 for general mains and cables, £5,400 for feeder cables, £350 for switchgear, £300 for protection gear, £5,000 for sub-stations, transformers and switchgear, £450 for wet-air filter, and £3,000 for additional connection to water mains—£14,850 in all. The total amount applied for was £26,775, but the amounts granted were for the more urgent and important items. The offer of the makers of the suction ash-plant at the generating station for altering and replacing certain portions, is recommended for acceptance.

Willesden.—The North Metropolitan Electric Power Supply Co. has given notice of its intention to extend the mains from Taylor's Lane to Wood Green. The Electricity Committee has agreed to supply energy to Messrs. F. E. Berwick & Co. for a period of three years, and the L.G.B. has sanctioned the borrowing of £500 for this purpose. The Commissioners of Inland Revenue have agreed to a reduced assessment in respect of the accounts of the electricity undertaking for the year 1914-15, which will result in a saving of £104.

TRAMWAY and RAILWAY NOTES.

Australia.—An order made by the Victorian authorities authorises the Prahran-Malvern Tramways Trust to construct an electric tramway from Kew to Malvern.—*Board of Trade Journal.*

Belfast.—At a special meeting of the Tramways Committee held last week, it was intimated that 42 applications had been received for the post of general manager of the Corporation's tramway system.

Blackpool.—Female Labour.—The Watch Committee was informed that the Blackpool, St. Anne's and Lytham Tramways Co. were proposing to employ women drivers; the Committee expressed its disapproval, holding that there were sufficient men over military age and discharged soldiers who were competent to do the work.

An exciting incident occurred last week on a corporation car, when a controller was completely burnt out, and the staircase was also severely scorched by the flames before the trolley could be disconnected from the overhead wire.

Continental.—Portugal.—The municipal authorities of Guimaraes are authorised to contract a loan of about £70,000 to be devoted to certain public works, including the installation of an electric tramway system between Braga and Guimaraes.—*Board of Trade Journal.*

Spain.—It is under consideration to employ electric traction for the express trains between Madrid and Valencia, whereby the journey will be made in five hours, with a single stop at Cuenca. The Madrid station will be underground, situated in the Calle de Montalban, fronting the Prado, on a site, however, already fixed upon by the Government to build the Ministerio de Marina. If this railway can be included among the secondary and strategic lines, its construction may be begun within a year, and in six years' time, says *Industria e Invenciones*, it will be in working order.

Dublin.—The tramway system is now running as usual; the rebuilding of Sackville Street, in which several important parts of the system run, including a couple of junctions and a terminus, may lead to some important changes of the system in that particular area.

East Ham.—Female Labour.—The T.C. is recommended to authorise the tramway manager to employ women as car conductors in the event of his not being able otherwise to fill vacancies.

Huddersfield.—Year's Working.—On the working of the Corporation tramways during the past year, there was a gross surplus of £63,229, and a net surplus of £13,014.

London.—Wandsworth.—The Town Clerk has been directed to call attention of the L.C.C. to the dangerous condition of the tramway rails in Upper Tooting Road, Tooting High Street and Garratt Lane.

Nottingham.—Collision.—On Saturday evening two cars on the Sherwood Rise section of the Corporation tramways came into collision, causing serious injury to one driver, while many of the 17 passengers received minor injuries. Both the car fronts were smashed, and much of the damage was due to broken glass falling amongst the passengers.

Salford. — Estimated Surpluses. — Ald. Jenkins (chairman of the Finance Committee), in his annual statement on the coming financial year, said the Tramways Committee promised £18,000 in aid of the rates, or £4,000 less than during the past year, and the Electricity Committee promised £6,500, or £3,000 more than was promised twelve months ago.

Sheffield.—Female Drivers.—At the Amalgamated Association of Tramway and Vehicle Workers' annual conference, a resolution was passed protesting against the employment of women drivers, the conference declaring that it would not allow it to come to pass except under the gravest national emergency.—*Sheffield Independent.*

U.S.A. — Large Railway Turbine Set. — Some further data concerning the 35,000-kw. turbine set for the South Boston station of the Boston Elevated Railway (to which we referred on page 398), appeared in a recent issue of the *Electric Railway Journal.* The set, which is to be built by the General Electric Co. (U.S.A.), is to operate on 200 lb. steam pressure and 200° F. superheat, and run at 1,500 r.p.m.; it will have a capacity of 42,500 kw. for two hours. The steam guarantee for the turbine at 200 lb., 1,500 r.p.m. and 1 in. back pressure, is as follows: 10,000 kw., 12·10 lb. per kw.-hour; 15,000 kw., 11·30 lb; 20,000 kw., 10·85 lb.; 25,000 kw., 10·65 lb.; 35,000 kw., 10·95 lb. For each 10 lb. per sq. in. increase or decrease in steam pressure the steam consumption is to decrease or increase by 1 per cent. from 185 lb. to 210 lb. per sq. in., and for each 10 5° increase or decrease in steam temperature between 175° and 225° F. superheat, the steam consumption will vary 0·5 per cent. At 2 in. absolute back pressure the guaranteed steam consumption per kw.-hour is as follows: 10,000 kw., 13·20 lb.; 15,000 kw., 12·30 lb.; 20,000 kw., 11·80 lb.; 25,000 kw., 11·60 lb.; 35,000 kw., 11·90 lb. An 18-in. steam pipe will be required for the unit, with a 10 ft. × 16 ft. exhaust. The generator will be a two-pole machine delivering 25-cycle three-phase energy at 13,200 volts pressure. Its guaranteed commercial efficiency is 97 per cent. at one-quarter load; 98·25 per cent. at half, 98·75 per cent. at three-quarter, and 99 per cent. at full load, not including friction and windage—roughly, 250 kw. With air at 40° C. the maximum armature temperature is not to exceed 100° C. at 35,000 kw. continuously, or 125° C. at 42,500 kw. for two hours. With full load 70,000 cb. ft. of air at 40° C. per min. will be required for ventilation.

York.—Female Drivers.—At a meeting of the Electricity and Tramways Committee last week, it was reported that in view of the extension of the system, it would be necessary to engage from six to eight female drivers. A motion that no women drivers should be employed was not seconded, and the recommendation will come before the City Council. Female conductors have been employed for some time, but the male staff has been considerably perturbed over the proposal to employ women drivers.

TELEGRAPH and TELEPHONE NOTES.

Spain.—A public wireless telegraph service has recently been inaugurated between Spain and Germany; the receiving and transmission stations are at Aranjuez and Konigswinterhausen respectively, and the charge is 2½d. per word.

The Telephone Service.—The P.O. Telephone Department has informed the Bromley Guardians that, owing to the shortage of staff and the havoc caused to wires by the recent storms, it is unable to entertain for the present orders for new installation work

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney.—June 20th. Municipal Council. Two-ton electric lorry. City Surveyor, Town Hall.

Perth.—August 16th. P.M.G. Telegraph and measuring instruments. Schedule No. 498, W.A.*

Barking.—June 9th. U.D.C. Six or twelve months' supply of coal, slack or beans. Engineer and Manager, Electricity Works.

Dewsbury.—May 31st. Twelve months' supply (about 2,500 tons) of steam coal for the electricity works. Specifications from Mr. R. H. Campion, Borough Electrical Engineer.

Dublin.—May 30th. Electricity Supply Committee. Cast-iron exhaust pipes and supports for 1,500-kw. Belliss engine. See "Official Notices" to-day.

Fleetwood.—June 3rd. U.D.C. Rough slack coal for 12 months (2,000 tons) for the electricity works. Mr. A. Cottam, Clerk.

Liverpool.—May 31st. Liverpool Overhead Railway. Twelve months' supply of electrical fittings. Particulars from General Manager, 31, James Street.

London.—May 30th. Metropolitan Asylums Board. Electricians' ironmongery and general stores for 12 months. Mr. T. D. Mann, Clerk.

St. Pancras.—Steam coal for 12 months for the Electricity Department. Borough Electrical Engineer.

Manchester.—May 26th. Electricity Committee. Stores for one year. Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

June 7th. Electricity Committee. Electric capstan for Stuart Street station. See "Official Notices" to-day.

New Zealand.—June 23rd. Oamaru Borough Council. Overhead mains and street-lighting equipment (Contract No. 2); power-station equipment (Pelton wheels, alternators, &c.) (Contract No. 3); service meters (Contract No. 4); line transformers and accessories (Contract No. 5).*

Pahiatua.—July 10th. Borough Council. Overhead wires, poles, street lamps, gas engines, producers, dynamos, auxiliary apparatus and accumulators. Specifications from Borough Offices or Mr. E. J. Fenn, Consulting Engineer, Auckland.*

Swindon.—May 30th. Corporation. Steam coal for the electricity works. See "Official Notices" May 12th.

Wigan.—May 31st. Extension to boiler house at electricity works. Specifications, Electrical Engineer's office, Wigan.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

London.—L.C.C. Traction glow-lamps for the Tramways Department: British Westinghouse Co., Ltd.

Maidstone.—B. of G. Renewal and repairs of internal telephone system: Oswald Jones & Co.

Meter Contracts.—Messrs. Chamberlain & Hookham, Ltd., have received contracts for meters for the ensuing 12 months for Southampton and Falkirk.

Rawtenstall.—T.C. Accepted tenders for cable and apparatus for supply of electricity to Haslingden:—

British Westinghouse Co., Ltd.—Transformer and switch panel.
W. T. Glover & Co., Ltd.—Cable.
Oates & Green, Ltd.—Conduits.
British Thomson-Houston Co., Ltd.—Switchgear.

Tynemouth.—Electricity Committee. 220 yards of three-core cable: Macintosh Cable Co.

Worthing.—B.C. A year's supply of 3 and 5-ampere electricity meters: The Electrical Apparatus Co., Ltd.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Friday, May 26th. At 5.30 p.m. At Albemarle Street, Piccadilly, W. Lecture on "X-rays," by Prof. C. G. Barkla, F.R.S.

Tuesday, May 30th. At 3 p.m. Lecture on "Optical Research and Chemical Progress," by Dr. T. M. Lowry, F.R.S.

Physical Society of London.—Friday, May 26th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Ordinary scientific meeting.

Association of Supervising Electricians.—Tuesday, May 30th. At 7.15 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "Internal Combustion-driven Electrical Sets," by Mr. W. A. Tookey.

Chemical Society.—Thursday, June 1st. At 8.30 p.m. At Burlington House, Piccadilly, W. Ordinary scientific meeting.

Royal Society of Arts.—Thursday, June 1st. At 4.30 p.m. At John Street, Adelphi. Paper on "The Work of the Imperial Institute for India," by Prof. W. R. Dunstan, F.R.S.

NOTES.

Effect of Imperfect Dielectrics in the Field of a Radiotelegraphic Antenna.—In Scientific Paper No. 269 of the Bureau of Standards, Mr. John M. Miller deals with the variation of the resistance of an antenna with the wave length of the oscillation. Starting from the wave length corresponding to the fundamental of the antenna, the equivalent resistance of the antenna rapidly decreases with increasing wave length, and reaches a minimum; as the wave length is still further increased, the resistance rises again, but in a linear manner. The decrease in resistance is explained by a decrease in the energy radiated in the form of electromagnetic waves as the wave length increases; this so-called radiation resistance varies, as it should, inversely as the square of the wave length. It has been difficult, however, to account for the linear increase which takes place at the longer wave lengths.

A recent paper by Austin pointed out the similarity in the linear increase in resistance of an antenna at long wave lengths with the behaviour of an absorbing condenser. The fact that in the curves which he had obtained for ship stations the rise in resistance was less marked than for land stations led him to believe that the absorption was probably caused by the ground acting as an imperfect dielectric. The measurements described in this paper verify Austin's hypothesis that the effect is caused by dielectric absorption, but do not confirm the supposition that the absorbing dielectric in question is the ground.

The observed large effect upon the absorption of variable air condensers brought about by the poor dielectric properties of small amounts of insulators in the electric field suggested to the author that the absorption in antennas was likewise caused by the presence of poor dielectrics in the field of the antenna. Experiments were accordingly carried out, and proved that in the design of an antenna it is a matter of importance to keep the dielectric absorption of the antenna, regarded as a condenser, as low as possible in order to minimise the waste of energy in the antenna, and so improve its efficiency as a radiator. The capacity through wooden masts, trees, buildings, insulators, &c., must be made extremely small in comparison to the capacity of the antenna through unobstructed air. In other words, the electrostatic field of force set up by the oscillating electric charges should not be occupied by imperfect dielectrics, and especially so where the electric force is intense. One important feature of design is to cover the interior walls of rooms into which the leads to the antenna run with grounded metal screens.

Electric Steel in Italy.—Five of the steel works in Italy are now provided with electric furnaces, the total number of the latter being 13. According to *Metallurgia Italiana*, the production amounts to 78 tons per day of 24 hours, the quantity of electrical power required being 6,800 KW.

Chief Technical Assistants' Association.—Owing to the war, it was thought advisable that the annual dinner of this Association should not be held, and an informal gathering of the members took place on Thursday evening, 18th inst., at the Villa Villa Restaurant. Advantage was taken of the occasion to present Mr. MacAlister, the hon. secretary, on behalf of the members, with a handsome rose bowl, as a token of their appreciation of the work which he has put into the launching and organising of the Association. The presentation was made by the chairman, Mr. J. T. Baron. In replying, the hon. secretary stated that as they had now reached practically the maximum of their membership, owing to the limited field from which their members could be obtained, it was hoped that the members would continue, as during the past 12 months, to contribute to the general welfare of the Association by further discussions on technical matters; and although by present arrangements a large number of subjects were down for discussion, these by no means exhausted the field which was open, and of which it was hoped all members would avail themselves. The following members supported the chairman and contributed towards the evening's success:—Messrs. Young, Bradshaw, Mason, Parker, Howell, Gregory, Thompson, and Manly.

Lay-Outs for Car Sheds.—Mr. N. L. Sanow, in an article in the *Electric Railway Journal*, gives some data resulting from an investigation with a view to finding what arrangement of track would call for the least number of car movements over switch, mate and frog in electric railway work when one car was passed to each of the branch tracks, as, for instance, at the entrance of a depôt. The life of a piece of special work is practically dependent on the number of movements across it, and any system which reduces the number will result in reduced maintenance. The author concludes that in place of the plain "ladder" track from which each diverging track turns off individually, it is better to arrange the branch tracks in groups of two or three or more, each group connected by a single branch-off to the principal ladder track. The saving in movements increases rapidly with the number of tracks in the lay-out, and exceeds 50 per cent. for equipments of moderate size.

Large U.S.A. Turbine Plant.—The Narragansett Electric Lighting Co., of Providence, R.I., has decided to install a 45,000-KW. turbine set at its South Street station, which will be of the Westinghouse cross-compound type similar to, but larger than, the units in operation at the Seventy-Fourth Street station of the New York Interborough Co., which have been described in our pages. The machine is to be capable of carrying a short-period load of 50,000 KW., and will operate at its most efficient rating on 11½ lb. steam per KW.-hr. The set comprises a high-pressure turbine of the reaction type, to operate on steam at 175 lb. and 100° F. superheat, direct-coupled to a four-pole generator running at 1,800 R.P.M. The H.P. turbine exhausts into a low-pressure turbine alongside, which is coupled to a six-pole generator running at 1,200 R.P.M. Both generators will deliver three-phase 60-cycle current at 12,000 volts, and will have an independent exciter. The L.P. turbine is of the double-flow type, each end exhausting into a separate jet condenser of the Westinghouse-Le Blanc low-head type, said to be the largest jet condensers constructed. The plant will require 18,000,000 lb. of circulating water an hour, when maintaining a 28-in. vacuum with water at 70° F.

The complete turbine set will measure 46 ft. 9 in. in length by 37 ft. in width, representing 26 KW. per sq. ft. of floor space.—*Power.*

Inquiries.—Makers of the "New Pacific" and "Empire" electric carpet sweepers are asked for.

Seats for Lift Attendants.—The Home Secretary desires to call the attention of occupiers and managers of business premises who have taken on, or may be taking on, women and girls to act as lift attendants, to the need which exists in certain circumstances for allowing the attendants facilities for resting in the intervals of work. There is a growing tendency, with a view to increasing the passenger accommodation, to make lifts without seats, and it has been represented to him that in busy establishments, where the lifts are running very frequently during certain hours, a considerable strain is placed upon the attendants, if the work is carried on without any opportunity of sitting down during such intervals as may occur. He would urge the provision of an attendant's seat when other sitting accommodation is not available, and in specially heavy cases where work is practically continuous, would recommend that one or two short intervals should be allowed for purposes of rest. A convenient form of seat, which is now being provided in some new lifts, consists of a wooden flap which closes flat against the side of the lift when not in use.

Fatality.—An inquest was held at Old Hill, on Friday, respecting the death of a lad named Humphreys (15), formerly in the employ of Burton, Dekingpole & Co. The evidence showed that the lad was helping to put on a belt, for which purpose he was hanging on to a beam in a stooping position, when he accidentally fell down as the result of an electric shock through coming in contact with an exposed electric wire. The medical evidence attributed death to the arresting of the heart's action by shock caused by electricity, and a verdict of "Accidental death" was returned, the jury exonerating the manager of the works from all blame.

Reforms in Education.—The executive of the Association of Education Committees has agreed to ask the forthcoming Conference to demand the immediate appointment of a Royal Commission on Education. The feeling of the members is that the educational system of the country will require much amendment to meet the struggle for supremacy after the war, and that a Commission should get to work at once, so that its recommendations will be ready to put in operation at the earliest possible moment. The Association represents the urban authorities of England and Wales.

The City Corporation has decided that the City of London Schools' Committee shall inquire into the syllabus of teaching at the City of London School for Boys, whether the chemistry teaching is adequate for modern requirements; and also as to the advisability of adding an engineering class to the course of instruction.—*The Times.*

Organised Science.—At the annual meeting of the British Science Guild last week, Sir Wm. Mather, the President, said that if the warnings of the founder of the Guild, Sir Norman Lockyer, had been heeded, we should have been in a far better position to carry on the war; it was at last being recognised that the organisation of science was indispensable to the prosperity of the nation. Mr. Andrew Fisher, High Commissioner for Australia, explained the constitution of the National Institute of Science and Industry in Australia, of which we gave particulars in our last issue. Moving a vote of thanks to Mr. Fisher, Surgeon-General Sir Alfred Keogh remarked that we had as able scientific men as any in Europe, who also had the invaluable quality of initiative. Dr. R. M. Walmsley, in seconding the motion, advocated strong efforts to re-establish British ascendancy in technical optics.

German Chemical Combine.—A new combine in the German chemical industry, which has been formed for a period of 50 years, is stated to be essentially a consequence of the war; it was felt that a syndication of the German chemical industry was necessary if the industry was to maintain its world-wide preeminence, more especially in regard to dyes. The new combine is stated to have a larger capital than any other existing German syndicate—namely, 225,800,000 marks. Its members are:—Badische Anilin und Soda Fabrik, Farben Fabriken Bayer, Aktiengesellschaft für Anilin-Fabrikation, Farbwerke Höchst, Leopold Cassella, Kalle and Co., and Chemische Fabriken Weilerter-Meer.

The Output of Coal.—At the suggestion of the Government, representatives of the coalowners and the Executive Committee of the Miners' Federation of Great Britain met in London last week to devise some scheme to stimulate the production of coal, which has fallen off in consequence of the withdrawal of labour for military service. The following resolution was unanimously adopted:—"In regard to absenteeism, this meeting agrees to the matter being referred to the districts on the distinct understanding that committees will be at once set up in the districts to provide and put into operation effective machinery to secure the attendance of all workmen employed to the fullest possible extent, and to inquire into the circumstances of workmen employed in the mines not being provided with work whenever they present themselves, the intention being to secure, as far as possible, the output of coal necessary for the country's needs." The joint meeting was adjourned to June 22nd to receive reports from the districts. The question of the suspension of the Eight Hours Act and the working of one hour extra per day for 60 days a year was also adjourned to the same date. It was decided to recommend to the several districts that the holidays should be curtailed, as far as possible, in the national interest, in order to increase the output of coal.—*Morning Post.*

Appointments Vacant.—Shift engineer (32s. 6d.), for the Holyhead U.D.C. electricity department. See our advertisement pages.

Rubber from Vodka.—The absolute prohibition of the drinking of spirituous liquors in Russia left a stock of nearly 7 million hectolitres of vodka available for other uses, and the Russian Government initiated researches with a view to finding industrial applications for it. A Moscow chemist named Ostromyslenski is reported to have found employment for it in the manufacture of synthetic rubber from butadienes obtained from oil-gas, and it is said that the Government has decided to erect a large factory for the purpose.

Electric Equipment of the Phœnix Assurance Co.'s Building.—With reference to our description of the above in the Electrical Review of May 5th last, we understand that the electric fires which are in use are of the "Revo" type, supplied by the Cable Accessories Co., Ltd., of Tividale, Staffs.

Large American Sign.—An unusually large electrical sign has recently been erected outside the premises of the Travellers' Insurance Co. at Hartford, Conn., U.S.A. The sign, which consists of the single word "Travellers," is 120 ft. long, with 9 ft. letters, and is stated to be readily legible at a distance of three miles.

German Cartels.—Prof. Hauser, in a recent communication to the *Bulletin* of the Société d'Encouragement pour l'Industrie Nationale, explains the part played by "cartels" in Germany's economic expansion. The "cartel," he says, cannot be defined as a form of industrial concentration, for a "trust" is also a form of concentration; but while a trust is the absorption of a number of enterprises by the strongest, as a brutal application of the struggle for existence, the cartel is a federative organisation which allows of the subsistence of individual enterprises. These enterprises merely renounce, on entry into a syndicate or cartel, a determinate part of their industrial or commercial autonomy. Juridically, a cartel is a joint-stock company among a number of producers, for the sale in common of the generality, or certain categories, of their products. Not every industry, and in a single industry, not all the products, are susceptible of subjection to the syndicate rule. A type of syndicate product is coal, and the Rhine-Westphalian syndicate in 1908 absorbed 98·7 per cent. of the total production of that basin; but for a cartel to succeed it is not enough that the product, for which it is created, should be subjected to the syndicate rule: it requires in addition, among the members forming it, a remarkable development of the spirit of association. Hence, as M. Hauser points out, foreign countries contemplating the introduction of this German trade method must take note of the actual conditions under which the German cartels work—the iron discipline which reigns among those consenting to be subject to it. The cartel, at least as it exists in Germany, is a specifically German institution; there are cartels in other countries, but they only remotely resemble those of Germany. It is a noteworthy fact that the cartel, if it has latterly served to favour exportation, was never conceived with that object; its primitive object was to struggle against over-production; but while permitting the syndicate producers to maintain prices on the home market, it also allowed them to export at prices defying foreign competition, their surplus product not consumed at home. It was between 1880 and 1885 that the German cartels began this exploitation policy, this policy of "dumping" which, by the way, is not a German invention, as is sufficiently shown by its name, and which consists in setting up two prices for the same product, or two scales of prices—a high price for the home market, and lower prices, varying with requirements, for foreign markets. This policy of dumping is, moreover, not without inconveniences, and M. Hauser gives several examples. In 1903, a big English shipbuilding company increased its exports to Germany by being able to buy German iron 30 per cent. below the cost of English iron. Belgium and Holland also exported into Germany nails and iron wire made with German iron. Facts such as these gave rise in Germany to vigorous opposition against the cartels. The inquiry, which took place in 1903 in consequence, resulted, however, in favour of the cartel, but with the stipulation that the latter consented to a reduction in home prices in favour of the German manufacturer exporting products. It was this new policy which the cartels had already begun to apply, which enabled Germany to oust, often completely, all competition in foreign markets, and to hinder the development of national industries in certain countries, such as Italy. With their system of premiums on exportation in all branches of industry, the Germans were able completely to strangle competition in foreign markets, and Government orders, and those of companies controlled by them mechanically, directly or indirectly, reverted to the German houses; it was in this way that, at the end of the crisis in 1906, French railway companies alone were customers for one-third of the German exports of locomotives. On the international board, says M. Hauser, the dice played by Germany were loaded, and it is foolish, under these conditions, to talk of "fair play" with so tricky a player. Steps should rather be taken to counteract and destroy the disloyal procedures of German cartels. Among means which are available to this end, M. Hauser commends those of the Canadian Government as the best. This stipulates that in case of sales below the prices of the country of origin, a double import-tax is levied—first the normal tax, based on the value of the invoice, and then a special tax, equal to the difference between the invoice price and the normal price. Arrangements such as these, M. Hauser thinks, the Allies should agree among themselves uniformly to enforce.—*La Revue Electrique.*

U.S. Production of Copper for 1916.—If the present rate of production is maintained, the U.S. refinery production of copper for the 12 months of 1916 will for the first time on record exceed 2,000,000 000 lb. The estimated figure for the year is 2,096,875,000 lb., an increase of 449,875,000 lb. over 1915, or 27 per cent. Five producers will be responsible for 78 per cent. of this increase. Never before in the history of the industry has the increase in any one year exceeded 150,000,000 lb.

In the face of an unprecedented outpouring of the metal, sales of hundreds of millions of pounds are being made to eager buyers for delivery up to the end of the year at 27½ cents. This is the figure understood to be the price to be paid for the 300,000,000-lb. order just closed with the British Government.

Not in any year since 1873 has copper sold above 26½ cents.

The copper producers would seem to be assured of a gross business this year of at least $524,000,000, and this assumes an average price of only 25 cents per lb. If an average of 27 cents is received, the producers stand to sell their product for $565,920,000. Such is the boom conferred by the European war. The full import of these figures is appreciated when placed beside the gross value of $288,220,000 for the 1915 production and $205,066,000 for 1914.—*Boston News Bureau.*

Italian Coal Resources.—Although Italy is endowed with water power available for hydro-electric purposes in excess of many European countries, the need for coal for steam-driven electric generating plants is pressing, in order to supplement the hydro-electric plants in the drier seasons of the year. Hitherto coal has been mostly imported, principally from England or Germany. Now, however, an attempt is to be made to explore and develop such deposits of coal—chiefly anthracite and lignite—as the country may possess. Prof. Novarese, head of the Royal Mining Corporation, states that there are extensive deposits of various kinds of useful coal in the peninsula, and a recent Government decree makes provisions to facilitate the search and winning of the home article. Prof. Novarese is of opinion that the Italian deposits could be made to yield 1,000,000 tons of fuel yearly, for electric stations, and even if of a quality somewhat inferior to the imported article, the present enhancement of the price of the latter would more than compensate for any deficiencies of the Italian fuel.

Late Legal.—Falk, Stadelmann & Co., Ltd., *v.* The General Cable Manufacturing Co.—Before a Divisional Court of the King's Bench Division, presided over by Mr. Justice Lush, an application was made on Wednesday regarding a new trial of this action, to recover in respect of certain Swiss electrical cable.

Mr. Clavell Salter, K.C., for the plaintiffs, said that a Divisional Court had heard an appeal from the County Court in this case, and had ordered a new trial, and a question had arisen as to whether it was intended that the new trial should be limited to certain issues. The goods were electrical cables, and defendants said there was a *force majeure* clause, and the contract was impossible because of the war. The County Court Judge found there was no *force majeure* clause in the contract, but he did not consider whether there was in fact *force majeure*. The question of impossibility he decided in favour of the plaintiffs, and he then assessed the damages. The Divisional Court took the view that the Judge did not properly determine if there was a *force majeure* term in the contract, but that the question of impossibility had been rightly decided, and at the new trial it would not be necessary to further consider the latter question. The order had been drawn up for "a new trial," without any such limitation, and as this litigation had proved costly, his clients were most anxious that the second trial should be of limited scope as directed by the Divisional Court. The only point was whether there was power to amend the order that had been drawn up.

Mr. C. Johnson, for the other side, said that the evidence must be the same again whatever happened, because evidence that would go to show that the contract was impossible of performance would also apply to the question whether there had been prevention by *force majeure* from the carrying out of their obligations. This was the third attempt made to limit the right of his clients to a new trial.

Mr. Justice Lush said that, while sympathising with the position of the plaintiffs, they could not alter the order that had been made for a new trial of the case. They ordered that the costs of the application should be costs in the cause.

Tests of Fire Extinguishers.—We have received from the Home Office the report of a Committee appointed to conduct experiments with a view to ascertaining the value of dry-powder fire extinguishers for coping with fires such as are caused by bombs. The tests showed that the dry powders checked the fire, but the application of buckets of water was far more effective in confining the fire to the immediate neighbourhood of the bomb, and eventually extinguishing the fire. A jet of water from a liquid extincteur was still more effective, but only extincteurs of reliable makes should be used. The Committee concludes that a plentiful supply of water is by far the best extinguishing agent, and that dry-powder extinguishers are practically useless for controlling fires caused by bombs. A small hose of ¾ in. diameter, similar to garden hose, with a nozzle of $\frac{3}{16}$ in. diameter (internal), supplied with water at a pressure of 45 lb. per square inch, and discharging at the rate of six gallons per minute, extinguished a bomb fire which had been allowed to mature for three minutes; at the end of six minutes from ignition of the bomb, the fire was completely out.

These conclusions are in accord with the recommendations of the British Fire Prevention Committee, which we published in our issue of May 28th, 1915.

The Inefficiency of German Electrical Machinery.—With reference to our recent leading article on "The Dearness of the Lowest Tender" (Elec. Rev., May 5th, 1916), we observe from the *B. of T. Journal* that his Majesty's Consuls in China have not been slow to take advantage of the opportunity which has been afforded by Mr. Aldridge's report on the troubles experienced with German turbo-alternator and other plant provided for the Shanghai municipal electricity works, to give assistance to British electrical manufacturers. The fullest publicity will doubtless be given to this important matter in China in circles where German cheapness has long been little short of a scandal. German dumping of electric motors, &c., in the Chinese market at ridiculously low prices has been one of the difficulties that our firms have long had to face, and object lessons of the Shanghai kind should have a very healthy effect, and go a good way to defeat the methods which German works were continually employing in China before the war. The beneficial effect of the tribute paid to British manufactures, in contrast to German, will not be limited to that market. It is one of those examples which might fairly and legitimately be turned to profitable account in all colonial and foreign markets where the under-cutting weapon of the Teuton has been so ruinously employed for the purpose of stifling British and other trading efforts. But have the British electrical manufacturers any efficiently organised means for ensuring that the industry shall reap all the good that widespread and discriminating circulation of the facts of the case should bring?

Increased Loom Production Due to Motor-Drive.—Investigations have been conducted in a New England worsted mill, to determine the actual extent of possible benefits by the substitution of electric motors for the existing mechanical drive. The mill contains 48 looms, which are run at a load factor of 62 per cent., and a speed which varies over 11 per cent., due to the irregularities of mechanical driving. The looms operate at an average of 105 picks per minute, and, on a 59-hour week, yield 119 yards of cloth per loom. Tests show that with the installation of group-motor drive an average of 112 picks per minute can be obtained, with a load factor of 72 per cent. The resulting output would then be 147 yards per loom per week, or a gain of 28 yards per loom. The selling price of the cloth is $1.50 per yard, so that the total value of the increased product is $2,016 per week for the 48 looms for a 50-week year, and, taking 5 per cent. of the selling price as the profit, this equals $5,040. The cost of making the change, which involves the purchase of six motors, aggregating 46 H.P. connected load, was estimated at $1,100. On this basis the electric drive would pay for itself in less than three months. *Electrical World.*

Lights on Vehicles.—The recent order of the Secretary of State prescribes the use of three lamps on vehicles, two in front, white, and one at the rear, red. From June 1st the police will be instructed to enforce the law in all cases where a contravention is observed.

A High-Head Turbine Plant.—For a long time the record for height of head has been held by the power station of Vouvry, in Valais, France, with a fall of 917 metres; it passed to the works of Orlu, in the Eastern Pyrenees, where the head was 6 m. greater, but has now been far exceeded by the Fully station, which, 500 m. above the sea-level, is fed by a lake at an altitude of 2,140 m., giving a head of 1,640 m., or 5,380 feet. Prof. R. Neeser, of Lausanne, states that the pressure conduit is 4,625 m. in total length, of which 2,300 m. has a diameter of 600 mm. (24 in.), and the remainder, 500 mm. (20 in.). The walls of the tube vary from 6 to 43 mm. (¼ to 1¾ in.) in thickness; up to 34 mm. the conduit is welded sheet, the rest being of weldless steel. With the exception of about 870 m. which is in tunnel, the pipe is buried in a trench 1 to 1½ m. deep throughout its length; no expansion joints are provided, and it is anchored at only one point—where it enters the works. The runner of the turbine, of the Pelton type, has a mean diameter of 3,550 mm. (140 in.) and consists of a disk of Siemens-Martin steel, weighing about 7,100 kg. (7 tons), and carrying 54 buckets. The jet is 34 mm. (1·34 in.) in diameter. The runner is carried on a steel shaft with journals 200 and 240 mm. (7⅞ and 9½ in.) in diameter, directly coupled to the alternator and running at a speed of 500 R.P.M.

The buckets are attached to the rim of the disk by a special method, patented in Switzerland by Léon Dufour; they are of pressed Siemens-Martin steel, and weigh 11·4 kg. (25 lb.) each.

The turbine is provided with an automatic regulator, which actuates a deflecting plate as well as the needle of the jet, the former acting quickly to take the load off the runner, and the latter more slowly, to prevent excessive pressure in the pipe line. A special arrangement is provided in the discharge pipe to cushion the jet when thus deflected, consisting of a cast-iron chamber followed by a converging steel casing leading to a horizontal pipe 1,300 mm. (51 in.) in diameter and 9 m. (29½ ft.) long, which is partly closed at the outer end, so that it always contains a quantity of water. This water receives the deflected jet, and absorbs the blow without injury to the walls of the passage; the device has proved quite satisfactory. The velocity of the jet at the needle valve is about 175 m. (574 ft.) per second, but at the outlet of the damping pipe its speed is reduced to a harmless value. Even under working conditions, the velocity of the water leaving the buckets is 30 to 40 m. per second, which, without such special provision would damage the masonry.—*La Revue Electrique.*

Institution and Lecture Notes. — Institution of Electrical Engineers.— A special meeting to consider the resolution to exclude alien enemies from membership of the Institution was to be held yesterday.

At the annual general meeting held on the 11th inst., the report of the Council and the statement of accounts were presented and adopted.

The result of the election of Council for the next Session was announced, as follows :—

President : Mr. C. P. Sparks.

Vice-Presidents : Messrs. R. A. Chattock,* R. T. Smith, C. H. Wordingham,* and Dr. A. Russell.

Hon. Treasurer : Mr. J. E. Kingsbury.

Ordinary Members of Council : Messrs. W. A. Chamen, J. Christie, H. Dickinson, Prof. T. Mather, Messrs. G. H. Nisbett,* G. W. Partridge, W. H. Patchell, W. Ll. Preece,* H. F. Proctor, G. S. Ram, R. J. Wallis-Jones, W. B. Woodhouse.

Associate Members : Messrs. F. W. Crawter,* H. H. Harrison,* W. R. Rawlings.*

Associates :—Messrs. J. O. Callender,* J. Devonshire,* J. Hunter Gray.

* Elected.

The President announced that the Willans Premium had been awarded to Dr. S. Z. de Ferranti, for his Presidential address in 1910.

University College, London.—Lecturing, on May 15th, on the manufacture of nitrates from the air by electric power, Mr. E. K. Scott gave three reasons why the war broke out when it did : Germany's new-found ability to dispense with Chile nitrates ; the perfection to which Zeppelins had been brought ; and the gyro compass for submarines. He dealt mainly with the direct electrical method of fixation of nitrogen, and demonstrated the importance of the compounds of nitrogen in the manufacture of explosives, in agriculture, and in the production of aniline dyes.

Volunteer Notes.—1ST LONDON ENGINEER VOLUNTEERS.—Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Monday, May 29th.—Technical for Sections 1 and 2, No. 3 Company, 46, Regency Street, S.W. ; Squad and Platoon Drill, Sections 3 and 4, No. 3 Company ; Signalling Class and Recruits.

Tuesday, May 30th.—School of Arms, 6 to 7 ; lecture, Mr. J. Roberts, "Water Supply," 7.15 ; Recruits, 7.15 to 8.15, Archbishop's Park.

Wednesday, May 31st.—Platoon Drill, No. 3 Platoon, No. 1 Company.

Thursday, June 1st.—Platoon Drill, No. 7 Platoon, No. 2 Company ; Shooting for Sections 1 and 2, No. 3 Company, Miniature Range ; Recruits, 5.45 to 7.45 ; Instructional Class, 5.45.

Friday, June 2nd.—Technical for Sections 3 and 4, No. 3 Company, 46, Regency Street, S.W. ; Squad and Platoon Drill, Sections 1 and 2, No. 3 Company.

Saturday, June 3rd.—Company Commander Fleming's Instructional Parade, 2.30.

Sunday, June 4th. — Entrenching duties : Parade, Victoria Station (S.E. & C. Railway Booking Office), 8.35 a.m. Uniforms, haversacks and water-bottles. Mid-day rations to be carried. Railway vouchers will be provided.

Musketry.—For Nos. 1 and 2 Companies, see Notice and Tables A and B, at Headquarters.

Notice.—Unless otherwise indicated, all drills, &c., will take place at Chester House.

MACLEOD YEARSLEY, *Adjutant.*

3RD BATT. (OLD BOYS) CENTRAL LONDON VOLUNTEER REGIMENT.—Battalion Orders by Capt. R. J. C. Eastwood (Commandant), Thursday, May 25th, 1916 :—

Week-End Parades.—Saturday.—The Battalion will Parade at Baker Street Station, at 2.30 p.m., and proceed by train to Wembley Park for Ceremonial Drill under the Commandant. Members who have their tunics at their tailors may attend.

Sunday.—The Battalion will Parade at Liverpool Street Station (Low Level entrance, G.E.R.), at 9.30 a.m., and proceed by train for Entrenching duties.

Musketry.—Inter-Battalion Cup Competition. A practice match has been arranged to be shot at Bisley on Sunday next, the 28th inst., between selected teams. Targets will be available for other members who attend. Members to report to Sergeant Burmester, at 10.5 a.m., Platform 6, Waterloo Station.

A. G. JOINER, *Major and Adjutant*, O.B.C.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

General.—Mr. AUGUST ECKSTEIN, electrical engineer, of Fallowfield, who was born in Bavaria before it became part of the German Empire, but has been permanently resident in England since 1887, was denationalised in 1888, and has been a naturalised British subject since 1894, has assumed the name of Arthur Erskine.

Mr. D. E. Ross has been gazetted second-lieutenant in the Tyne Electrical Engineers, R.E. He has been on dispatch riding in France for about a year.

The *Times* states that the curators of Edinburgh University on Monday appointed Sir JAMES ALFRED EWING, Director of Naval Education, Principal in the room of the late Sir William Turner.

Councillor C. ATKINSON has been re-appointed chairman of the Fleetwood Electricity Committee.

Roll of Honour.—Intelligence has reached Rugby of the deaths in action of five former employés of the British Thomson-Houston Co., Ltd. Rifleman E. FRANKLIN, of the Rifle Brigade, who was in the winding department, has died of wounds received on April 12th; Private R. DAVIS, of the Oxon and Bucks Light Infantry, has been killed by a trench mortar; Bombardier E. COX, of the Rugby Howitzer Battery, formerly a charge-hand in the turbine department, has been killed by shrapnel; Private B. BLAKE, of the Wiltshire Regiment, who was in the purchasing department, is reported killed in action, after being missing since June 16th last; and Lance-Corporal J. T. GURNEY, of the Royal Warwickshire Regiment, reported missing since April 21st, 1915, is now listed as dead.

The death in action is reported of Private J. JEFFRIES, of a Shropshire Regiment, who was an employé at Darwen Corporation electricity works.

Private J. H. DORBER, of the South Lancashire Regiment, formerly employed by the Osram Lamp Co., at Manchester, has been killed in action.

Private RICHARD SILCOCK, of the Canadians, who has been killed in action, was formerly employed at the works of the Chloride Electrical Storage Co., Clifton Junction.

Captain GERARD R. FLEMING, Scottish Rifles, who has been wounded, was, before joining the Army, in the employment of Messrs. Wm. M'Geoch & Co., of Glasgow.

Rifleman JOHN BARKER, Royal Irish Rifles, formerly employed at the British Westinghouse Works, Trafford Park, who was previously reported missing, is now officially reported killed. Another former worker at the Westinghouse Works, Sergeant E. MURRAY, of the Loyal North Lancashires, has been killed. Private ARTHUR ETTERICK, of the Black Watch, who has died from wounds, was also employed prior to enlistment at the British Westinghouse Works, Trafford Park.

Lance-Corporal R. QUINN, of the Manchester Regiment, formerly employed by Messrs. Hans Renold, Ltd., has been killed in action.

Corporal ELIJAH BAUGH, before the war employed as an electrical fitter by the General Electric Co., Ltd., Salford, has been seriously wounded in action.

The death in action is reported of Sergeant R. W. WOODS, Loyal North Lancashire Regiment, who was formerly employed at Messrs. Dick, Kerr & Co.'s works, at Preston.

Obituary.—MR. R. W. TWEEDY.—The death has occurred of Mr. Robert Wilkinson Tweedy, chairman of Messrs. Tyer and Co., Ltd., electrical and general engineers, Denton Holme, Carlisle, and Dalston, London. Deceased, who was 69 years of age, entered the business of his father at Carlisle, of which he ultimately became sole proprietor. On amalgamation with Messrs. Tyer & Co., 16 or 17 years ago, he became local managing director, and subsequently was elected chairman of the company. He had served on the Carlisle City Council and Cumberland County Council.

SIR CORBET WOODALL.—We regret to record the death of Sir Corbet Woodall, governor of the Gas Light & Coke Co., at the age of 75 years.

HERR F. GNAUTH.—The death has occurred, at the age of 62 years, of Herr F. Gnauth, the general director of the Felten & Guilleaume Carlswerk Gesellschaft, of Mulheim, Cologne.

NEW COMPANIES REGISTERED.

F. J. Shenton & Co., Ltd. (143,861).—This company was registered on May 17th, with a capital of £3,500 in £1 shares (3,000 ord. and 500 "B"), to carry on the business of munition makers, electrical, telephone, telegraph, mechanical, and general engineers and merchants, electricians, electroplaters, fitters, millwrights, founders, stampers, galvanisers, japanners, annealers, enamellers, painters, &c. The subscribers (with one share each) are : W. A. Barber, 51, Penshurst Road, Thornton Heath, Surrey, clerk ; J. A. Matthews, 38, Lambton Road, Hornsey Rise, N. clerk. Private company. The number of directors is not to be less than two or more than five ; the first are F. J. Shenton (managing director) and E. H. Smith (chairman). In the event of the decease of the said E. H. Smith, his father, L. J. Smith, or failing him, the personal representatives of the said E. H. Smith, shall have the right to appoint a director in his place. Remuneration of E. H. Smith, £50 per annum ; of managing director, as fixed by agreement ; of other directors, as fixed by the company. Registered office : 284, Queen's Road, Peckham, S.E.

Quead, Ltd. (143,850).—This company was registered on May 15th, with a capital of £7,000 in £1 shares, to take over the business of vendors and manufacturers of gas and electric stoves, heaters, lamps, and apparatus and appliances relating thereto carried on by F. Eads and R. J. Quainton, at 47, Marylebone Lane, W., as Eads & Quainton. The subscribers (with one share each) are : F. Eads, 47, Marylebone Lane, W., manufacturer of electric fires, &c. ; F. L. Wright, 66, Windermere Road, Ealing, W., [illegible]

neer; R. J. Quainton, 47, Marylebone Lane, W., engineer. Private company. The number of directors is not to be less than two or more than five: the first are F. Eads (permanent), F. L. Wright, and R. J. Quainton. Qualification. £100 shares. Secretary: H. Middleton. Registered office: 47, Marylebone Lane, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Lamplough & Sons, Ltd.—Mortgage, created by Receiver, dated May 16th, 1916, to secure £1,200, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: H. E. Taylor, 35, Church Road, Richmond, Surrey.

CITY NOTES.

United River Plate Telephone Co., Ltd.

The gross earnings of the company for 1915 amounted to £641,581, whilst the gross maintenance and other charges in Argentina and London were £447,810, leaving the profit for the year at £193,771. Deducting interest on debenture stock, preference dividend for the year, and the interim ordinary dividend, and adding £6,563 brought forward, £128,234 remains. Of this, £2,000 has been put to the staff provident fund, £20,000 to the reserve fund, £19,000 to depreciation of securities account, and a final dividend of 5s. per share on the ordinary shares, making 8 per cent. for the year, free of income-tax, absorbs £81,000, leaving £6,234 to carry forward. Annual meeting: May 30th.

Anglo-Portuguese Telephone Co., Ltd.

The annual meeting was held on May, 16th, Mr. HERBERT ALLEN presiding. The chairman said that in a year of great events in the outer world the affairs of the company had been singularly uneventful. They earned £81,923, against £71,339 in the previous year, and expended £54,037, as against £44,875, and the gross profit was £27,886. The commercial and financial situation in Portugal was no better than one would expect it to be after the political turmoil prevailing throughout the country during recent years, and it was not easy under such circumstances to explain the steady growth of this company's business, unless it were due to their excellent service, combined with a moderate tariff. The number of subscribers increased during the year by 10½ per cent., and the gross revenue by 14 per cent. Unfortunately, however, the net profit showed little advance on that of the previous year, owing partly to the increased cost of labour and material and in greater measure to the loss on exchange. The Lisbon exchange on London was now only 34d. per escudo, a fall of about 20 per cent. in less than two years, and that it was not worse was due to the fact that imports into Portugal had practically ceased, and that the Brazilians and rich Portuguese, who formerly spent most of their time in Paris or Biarritz, were obliged now, on account of the war, to take up their residence and spend their money in Lisbon or Oporto. How they were to meet the steadily increasing cost of labour and material was not quite clear. The Portuguese railways, both private and State-owned, had solved the problem by an increase of 10 per cent. in their tariff, and if such a step could be justified in the case of native enterprises it should be still more allowable in the case of foreign companies, which had to send their profits out of the country. He feared, however, any such increase on their part would be resented by the public, and therefore was out of the question. Capital expenditure during the year was lower than for some years past. In normal times this would be no subject for congratulation, because the constant aim of a telephone company was to enlarge the scope of its operations, and that, of course, could only be done by liberal capital expenditure. But under existing conditions, when Treasury sanction for new issues was difficult to obtain, it was perhaps as well that capital requirements were, if only temporarily, on a moderate scale. This provision of working capital was a question that did not leave them altogether free from anxiety, because there must be no slackening of effort to meet the requirements of an ever-growing telephone public. At the present time the business was expanding at an unprecedented rate, and scarcely had they got their new exchange at Lisbon into working order than they were confronted with the possible necessity of further extensions. How much longer they could defer the opening of a new exchange at Oporto he did not know. For the time being the policy of the board was to restrict new work as far as possible to the actual bringing in of subscribers, but the present rate of progress could not be maintained without an adequate increase in the capacity of the exchanges and of the cable routes. Having regard to all the circumstances, it was scarcely probable that normal capital requirements would henceforth be under £20,000 a year, and the tendency would be to increase rather than to fall away. Should they be called upon to extend the area of their operations beyond Lisbon and Oporto, this estimate might be considerably increased. As in the past, they would hope to meet this expenditure largely out of surplus or undivided earnings, but the continued rise in the Lisbon exchange was making serious inroads on the profit and loss account, and the diminished surplus, if they were to maintain their normal rate of dividend, would necessitate raising some, at all events, of the requisite funds by an increase of capital in one shape or another. Fortunately their present financial position was quite satisfactory, and, subject to the absence of any turn for the worse in the military situation, they could see their way ahead for well over a year.

Electric Construction Co., Ltd.

The net profit for 1915, after providing £6,648 for debenture interest and £7,500 for depreciation, is £43,241, plus £7,471 brought forward. After paying 7 per cent. on the preference shares, and 7½ per cent. on the ordinary for the year, £12,664 is to be put to general reserve fund (making it £50,000), leaving £16,839 to be carried forward, subject to excess profits duty and assessment under Munitions of War Act, 1915. The works were declared controlled in August last. Notwithstanding the very high price of materials and an all-round increase in the cost of manufacturing, the net profits for the year were satisfactory. The improved results are due principally to a larger volume of orders having been handled through the unremitting efforts of the staff and workmen. Unexecuted orders at the beginning of the new financial year exceeded those on hand a year ago. Annual meeting: May 30th.

Shanghai Electric Construction Co., Ltd.

At the annual meeting, held in London on May 19th, the chairman said that the falling off in receipts referred to a year ago continued until the early autumn, when a marked improvement took place, and in the later months of the year nearly all the loss was recovered. The receipts for 1916 had so far continued on the same improved basis, and the position was now certainly hopeful. The trade of Shanghai also improved during the second half of the year, and the company had benefited by this, and by an increasing influx of natives into the Settlement in consequence of the disturbances in China. The gross traffic receipts were £117,975, less £31,707 for loss by native copper coinage, leaving effective receipts of £86,268, which was practically the same as in 1914. After deducting the working expenses in Shanghai, an operating profit remains of £35,003, as compared with £35,892 in 1914. After paying the 7 per cent. dividend, £1,387 was to be carried forward. The expenditure on construction account was £12,567, about £10,000 less than last year, chiefly for 10 new motor cars, temporary overhead feeder cables, land for sub-stations, buildings extension, &c. The power expenses had been reduced from £9,814 to £8,684, and had been brought down to 2.97 cents per car mile against 6.15 in 1909, the average cost per unit being 3.10 cents. A further reduction per unit was looked for when the Council had completed its new Riverside station, when the company would be able to do away with the overhead feeder cables which were put in to replace the original underground cables, which had proved unsatisfactory in many instances. The overhead cables were purchased on favourable conditions, and the materials at to-day's prices could be sold on terms that would go a long way to cover the original cost. In 1915 they carried nearly 60 millions of passengers, against 11¾ millions in 1909, and during the first three months of this year they had carried 15½ millions, or at the rate of 62 millions per annum. As they anticipated that this increase would be maintained, they had applied to the Municipal Council for permission to introduce 15 new trailers. Notwithstanding the assurances given to the Diplomatic body in Peking by the Chinese Minister of Finance, the depreciation of native copper coins had been accentuated, and the ratio of loss to gross receipts had been increased to 28.58 per cent.—9.91 per cent. on the share capital, as compared with 26.04 per cent. in 1914, and the loss for the year was £28,038, against £25,880 in 1914. At present there were good reasons for believing that the depreciation would be arrested at no distant date, and should this charge on the receipts be minimised or eliminated altogether, it was obvious that their account would in future be very materially improved. The rise in the silver exchange was also greatly to their advantage. In regard to railless traction, the Fokien new roadway had been completed in cement concrete, and the company's railless service was resumed on July 7th, the weight of the cars being reduced to meet the Council's requirements. The cars so altered had operated most successfully on the smooth surface, and since the opening to December 31st they had carried 1,439,804 passengers, run 49,753 car miles, and collected a gross revenue of $19,347.49, which, after deducting loss on native coinage, working expenses and depreciation, had paid over 6 per cent. per annum on the capital employed. The route (less than ¾ mile) was too short to get the full benefit of the seven cars available, and they had applied to the Council for an extension, which the popularity of the service and the success of the experiment should justify. They were looking forward for opportunities to expand this form of traction at no distant date, as it was proved to be well suited to the narrow streets and to the requirements of the population. They also hoped that when the war was over and the disturbances in China had ceased, the inquiries made as to starting tramways in other townships in the interior might lead to the company being invited to take an interest in such schemes, as their experience should certainly be useful to those concerned in any such new undertakings in China. Mr. Doran,

a useful member of the staff, came home on leave to join the Army, and the deputy general manager, Mr. Smeaton, was home on leave for medical treatment. Thanks were due to the local board and to Mr. McColl. Owing to the death of General Thys last year, and to the enforced absence of M. Francqui, M. le Chevalier Edmond Carton de Wiart had been invited to represent the large Belgian interest in the company.

Anglo-Argentine Tramways Co., Ltd.

For 1915 the gross receipts were £2,709,616, less working expenses (which include £120,000 carried to depreciation renewals reserve, in addition to £265,692 expended on ordinary maintenance) £1,786,740, leaving £922,876. After adding interest on investments and deposits and transfer fees, £45,637, and £96,409 brought forward, the amount is £1,064,922. Interest and charges, absorbing £970,802, are made up as follows:—Annuity to City of Buenos Aires Tramways Co. (1904), Ltd., £70,000, 4 per cent., 4½ per cent., and 5 per cent. debenture stock interest, sinking fund for redemption of debenture and share capital, and 5½ per cent. dividend on the first and second preference. The balance forward is £94,120. During the year there was a further fall in receipts of £141,380, but by the exercise of strenuous economies the expenditure was reduced by £94,256, and it "now probably represents the minimum compatible with efficiency," while the position is aggravated by the continuous rise in the cost of fuel, upon which the price paid for electric current is based. Having regard to the difficulty of forecasting the results of the present year, the directors are unable to recommend the payment of a dividend on the ordinary shares. The balance at the credit of the profit and loss account, £94,120, has accordingly been carried forward. The general manager, Mr. G. Pedriali, in a most exhaustive report, shows how building operations in the city of Buenos Aires came to an almost complete standstill, immigration was reduced to a minimum, and the population fell. The traffic suffered more even than in 1914. The passengers carried were approximately 317 millions, a decrease of 4.5 per cent. This includes 30½ millions of subway passengers (an increase of 7.1 per cent.). The car km. run were 81½ millions, a decrease of .09 per cent. The surface receipts decreased by 6.7 per cent., and those for the subway increased by 7.1 per cent. During the year 64 new cars received from Preston were delivered to traffic. The number of motor-cars has increased from 1,768 to 1,800, the convertible trailers from 407 to 426, and the motor trolleys from 49 to 55. Details are given of the number of breakdowns of cars and of electrical equipments, also particulars concerning the maintenance of the overhead system, cables, permanent way, and buildings. A reduction of 6 per cent. has been effected in average consumption of the subway cars. The electric current used for traction has diminished by 1,105,469 KW.-hrs., and the figures per car km. run show a continued decrease. The average cost of current per KW.-hr. for traction increased from 1.431d. to 1.544d., or 7.9 per cent. Coal cost considerably more than in 1914, and but for a favourable petroleum contract the 1915 figures would have been exceeded. North American coal was largely used, three cargoes only of Welsh coal having been received in the early part of the year. The North American coal does not give such good results as best Cardiff. Petroleum has given excellent results as regards consumption per KW.-hr. The KW.-hr. of current produced required, before the war period, 884 grammes of best Cardiff coal. During 1915, owing to the use of petroleum, this figure was never reached until December, when North American coal alone was used, when the consumption was 959 grammes for every KW.-hr. of current generated, which added over 8 per cent. to the price of current. The company will be prejudiced greatly if North American coal continues to give inferior results, taking both cost and production of current into consideration. The increased cost of current has added largely to the working expenditure. The amount paid to the D.U.E.G. in 1915 for energy was £355,574. If prices of fuel had been at the normal conditions in accordance with the base price in the contract, *i.e.*, less than 7.75 gold per ton, the cost would have been £289,253, so that the difference added to working expenditure amounted in 1915 to £66,321. Mr. Pedrali closes his report with a reference to prospects as follows:—

> Never has it been more difficult to form an idea as to what the year may bring about, or the effect, either directly or indirectly, that the state of European affairs will have on our receipts. There is little doubt that no improvement on a large scale can be anticipated. Should things continue as at present, I should say that a very gradual and hardly perceptible increase will take place, but there are nowadays so many factors which may affect us at a moment's notice that this opinion must be accepted as absolutely precarious. Expenses have been cut down to the utmost limit in every department, but where we are quite unable to form an estimate of expenditure is in the expense of electric current. The price of coal and other fuel has reached such unheard-of prices (nearly three times the normal), and the outlook is so extremely obscure, that I am afraid our profit for the year will be very gravely affected by this state of affairs.

The annual meeting took place yesterday.

Swiss Electrical Companies.

The directors of the *Gotthardwerke, A.G. fur Elektrochemische Industrie, of Bodio*, state that the works were occupied to the limit of their capacity in 1915, and they propose a dividend of 10 per cent., as against a rate of 8 per cent. in 1914.

The Elektrizitats Gesellschaft Baden, in which the firm of Brown-Boveri is interested, reports net profits of £4,900 for 1915, as against £3,600 in the previous year. It is proposed to distribute 6½ per cent., as compared with 5½ per cent. in 1914.

The Motor A.G. fur Angewandte Elektrizitat, of Baden, which owns generating stations, and is also interested in supply works, in various countries, records net profits of £87,000 for 1915, as contrasted with £99,000 in the preceding year. The directors recommend a dividend at the rate of 7 per cent. on the ordinary share capital of £1,200,000, being the same rate as in each of the three preceding years.

Anchor Cable Co., Ltd.—The report for 1915 states that the profit, after making provision for war taxes and contingencies, amounted to £47,251, plus £32,129 brought forward. Interest on debenture stock absorbs £2,250, depreciation £20,000, written off investments £107, leaving an available balance of £57,023, which it is proposed to deal with as follows:—Dividend of 20 per cent. on the shares £13,000, carrying forward £44,023.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets have further developed the accession of strength to which we have drawn attention in our last two issues. Various reasons are ascribed for the substantial buying now in progress. Some people put it down to rumours of peace and consequent eagerness on the part of investors to get in before the expected peace boomlet starts. Others say that the buying is simply employment of capital which is being made out of munitions and war-work generally. Possibly both reasons contribute to the robustness of investment markets as a whole—a strength which is led by Consols and which permeates practically everything of an investment nature.

The spectacular event of the week is a rise of over 20 points in a day in Cities Services common shares. The company has just issued its annual report to April 30th last, showing a remarkable expansion in profits; and Montreal vied with New York in competing for shares. Another feature of the week is a spurt in Brazilian Traction common shares, which carried the price from 56½ to 64½, with hardly a break. The motive power here, also, was New York buying, with the Rio exchange up to 12 9/16d. to back it. The Home Railway market is good, with further recoveries in the Undergrounds; and amongst the industrial descriptions, manufacturing shares stand out with noticeable firmness.

It is something of an anti-climax to go on to remark that home electricity shares are inclining rather to the dull side. County of London preference and Westminster ordinary are both easier. The only improvement in the list is one of 1/16 secured by the London Electric shares; and the market explanation of the dulness of this section naturally falls back upon the Daylight Saving Bill as responsible for holding back orders which might otherwise have come in. The tone, notwithstanding these two small falls, is quite good; and any resumption of demand for the shares would put up prices smartly enough.

Another dull spot in the following price lists is that for Anglo-Argentine Tramway shares. The report of the company elaborates the reasons for the directors' decision not to recommend the payment of a dividend on the ordinary shares. The continuous rise in the cost of fuel is the principal difficulty; and the directors state that expenditure has been reduced until it now probably represents the minimum compatible with efficiency. The meeting was fixed for the Thursday in this week.

Central London assented ordinary stock, after being stagnant literally for months, suddenly developed strength and rose 2½ to 70, with very little stock to supply the buyers. District ordinary gained ¼, and Underground Electric income bonds held their previous good rise. The Home Railway market is good in all its sections. Removal of the minima from the prior-charge stocks has brought in more buyers than sellers; and instead of the expected flood of stock, the market is astonished to find that there is little supply to meet the considerable demand. Nor is this the case in London only, for correspondents of ours report that the same conditions prevail in the Glasgow Stock Exchange, while from some of the other important provincial centres there are insistent inquiries for the offer of reasonably-priced stock.

It is in the telegraph market that the principal strength is shown. The Eastern group is again favoured; there are rises in "China" shares, Eastern ordinary, Globes, and Western shares. The American section is also decidedly better on the week. Anglo-American Telegraph deferred is up to 22, a rise of ⅛; and the preferred stock has at last gone over par. American railway shares enjoyed a boom on their own account; and almost everything connected with the States is held in high favour.

West India and Panama shares recovered 1s. 6d. to 19s., support being rendered on the assumption that the directors had done the wisest thing in passing the dividend, and so laying the foundation for a better year next time. United River Plate Telephones rose another ½ on the issue of the report, which makes pleasant reading for the proprietors. Marconis improved to 44s. 6d., and there has been a little

business in Americans on the basis of 14s., though in others of the group there has not been much alteration.

One important feature of the week is the announcement of a working agreement between Brunner, Mond & Co. and the Castner-Kellner Alkali Co. The secret had been very well kept, and the news of the *rapprochement* caused a sharp rise in the shares of both companies, Castner-Kellners gaining ⅛ at 3 7/16. Electric Constructions put on 6d. to 17s., the report being even more satisfactory than the dividend announcement had led the market to expect. Callenders are nominally unchanged at 11½, but there are very few shares about, and the company's report, which came out a few days ago, shows the undertaking to occupy a very strong position.

The news from Mexico does not greatly encourage activity in the stocks and shares connected with the country. At the same time, however, with such rapid rises taking place in the prices of stocks in companies that operate in North and South America, there is more disposition to look kindly upon the Mexican utilities, with the result that the 5 per cent bonds of the Tramways and the Mexican Light and Power concerns have each a rise of a point to their credit.

In the armament group there is no change from the previous quietude, but the rubber market continues to improve. Although the price of the raw material hangs back, buyers are once more pressing in to take advantage of the slightly lower prices than those which ruled a few weeks ago. At the same time, the excitement which then characterised the market is not so evident, thanks, of course, to the spread of public interest to so many other sections of the industrial market.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1914.	Dividend 1915.	Price May 23, 1916.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	10	6⅝	—	£7 8 2
Charing Cross Ordinary	5	5	8½	—	7 13 10
do. do. do. 4½ Pref.	4½	4½	8½	—	6 18 6
Chelsea	5	4	6¼	—	6 8 1
City of London	9	8	12	—	6 13 4
do. do. 6 per cent. Pref.	6	6	10½	—	5 14 3
County of London	7	7	10½	—	6 16 7
do. 6 per cent. Pref.	6	6	10⅜	— ⅛	5 15 8
Kensington Ordinary	9	7	5	—	7 0 0
London Electric	4	3	1 5/16	+ 1/16	7 11 0
do. do. 6 per cent. Pref.	6	6	4¼	—	7 1 2
Metropolitan	3½	3	2⅝	—	6 6 4
do. 4½ per cent. Pref.	4½	4½	8	—	7 10 0
St. James' and Pall Mall	10	8	6	—	6 13 4
South London	5	5	2⅞	—	8 13 10
South Metropolitan Pref.	7	7	1 7/16	—	6 14 0
Westminster Ordinary	9	7	5⅝	— ⅛	6 4 5
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	101 xd	+1	5 19 0
do. Def.	30/-	33/6	22	+ ⅜	7 10 9
Chile Telephone	8	8	6⅜	+ ⅛	6 5 6
Cuba Sub. Ord.	5	5	7⅛	—	6 18 4
Eastern Extension	7	8	14⅜	+ ⅛	*5 11 4
Eastern Tel. Ord.	7	8	146	+2	*5 9 7
Globe Tel. and T. Ord.	6	7	12⅜	+ ⅛	*5 14 3
do. Pref.	6	6	10¼	—	5 17 5
Great Northern Tel.	22	22	36½	—	6 0 7
Indo-European	13	13	49	—	6 12 8
Marconi	10	—	2 7/32	+ 1/32	4 10 4
New York Tel. 4½	4½	4½	100⅜	—	4 9 4
Oriental Telephone Ord.	10	10	11⅜	—	5 10 4
United R. Plate Tel.	8	8	6 7/16	+ 1/16	*6 9 4
West India and Pan.	1	Nil	19/-	+1/6	9 6 1
Western Telegraph	7	8	14½	+ ¼	*5 10 4
Home Rails.					
Central London, Ord. Assented	4	4	70	+2½	5 14 4
Metropolitan	1½	1	25½	—	3 18 6
do. District	Nil	Nil	19½	+ ½	Nil
Underground Electric Ordinary	Nil	Nil	1⅜	—	Nil
do. do. "A"	Nil	Nil	6/-	+6d.	Nil
do. do. Income	6	6	87	—	*6 18 0
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅝	— ⅛	6 6 4
Anglo-Arg. Trams, First Pref.	5½	5½	3½	—	7 17 2
do. 2nd Pref.	5½	5½	3½	—	8 9 2
do. 5 Deb.	5	5	78	—	6 8 2
Brazil Tractions	4	4	64½	+8	6 4 0
Bombay Electric Pref.	6	6	10⅝	—	5 15 8
British Columbia Elec. Rly. Pfce.	5	5	59	—	9 9 8
do. do. Preferred	—	Nil	40	—	Nil
do. do. Deferred	—	Nil	88	—	Nil
do. do. Deb.	4½	4½	62	—	6 17 1
Mexico Trams 5 per cent. Bonds	—	Nil	42	+1	Nil
do. 6 per cent. Bonds	—	Nil	35	—	Nil
Mexican Light Common	Nil	Nil	20	—	Nil
do. Pref.	Nil	Nil	33	—	Nil
do. 1st Bonds	Nil	Nil	42	+1	—
Manufacturing Companies.					
Babcock & Wilcox	14	15	2⅝	—	5 14 3
British Aluminium Ord.	5	7	22/- xd	—	6 7 3
British Insulated Ord.	15	17½	10½	—	7 2 10
British Westinghouse Pref.	7½	7½	44/-	—	6 16 6
Callenders	15	20	11½	—	6 10 5
do. 5 Pref.	5	5	4½	—	5 17 8
Castner-Kellner	20	—	3 7/16	+ ⅛	5 14 3
Edison & Swan, £3 paid	Nil	—	10/6	— 6d.	Nil
do. do. fully paid	Nil	—	1⅜	—	Nil
do. do. 5 per cent. Deb.	5	5	57	—	8 15 8
Electric Construction	6	7½	17/-	+ 6d.	8 16 6
Gen. Elec. Pref.	6	6	9⅜	—	6 4 8
Henley	20	—	14½	—	*6 18 0
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	10½	—	*9 10 6
Telegraph Con.	20	20	37	—	*6 16 0

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, May 24th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec
a Acid, Oxalic	per lb.	1/8	..
a Ammoniac Sal	per ton	£75	..
a Ammonia, Muriate (large crystal)	"	£54	..
a Bisulphide of Carbon	"	£23	..
a Borax	"	£30	£2 inc.
a Copper Sulphate	"	£53	..
a Potash, Chlorate	per lb.	2/6	..
a " Perchlorate	"	2/-	..
a Shellac	per cwt.	96/-	..
a Sulphate of Magnesia	per ton	£18	..
a Sulphur, Sublimed Flowers	"	£14	..
a " Lump	"	£10	..
a Soda, Chlorate	per lb.	1/4½	..
a " Crystals	per ton	120/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	1/5⅞ to 1/6	⅛d. inc.
c " Tubes (solid drawn)	"	1/6½ to 1/7	¼d. to ½d. in.
c " Wire, basis	"	1/6½ to 1/6½	⅛d. inc.
c Copper Tubes (solid drawn)	"	1/9 to 1/9½	⅛d. inc.
g " Bars (best selected)	per ton	£174	£7 inc.
g " Sheet	"	£174	£7 inc.
g " Rod	"	£174	£7 inc.
d " (Electrolytic) Bars	"	£160	£8 inc.
d " " Sheets	"	£178	£8 inc.
d " " Rods	"	£167	£8 inc.
d " " H.C. Wire	per lb.	1/8	1d. inc.
f Ebonite Rod	"	8/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	2/3	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	2/8½	1½d. dec.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£36	..
g Lead, English Pig	"	£33	£2 5 dec.
g Mercury	per bot.	£16 12 6 to £16 15	..
e Mica (in original cases) small	per lb.	6d. to 8/-	..
e " " " medium	"	8/6 to 6/-	..
e " " " large	"	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/8½	..
r Steel, Magnet, in bars	per ton	£85	..
g Tin, Block (English)	"	£197 to £200	..
n " Wire, Nos. 1 to 16	per lb.	3/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Mirrlees, Bickerton & Day, Ltd.—The report for the year ended March 31st states that the net profit, after providing for depreciation and directors' fees, is £16,101, which, with £1,730 brought forward, makes £17,831. Dividend at the rate of 7½ per cent., less tax, on the ordinary share capital; £5,000 to reserve; £2,037 carried forward.—*Financial Times.*

West African Telegraph Co., Ltd.—The net profit for 1915, including £633 brought forward, is £25,347. £13,000 has been transferred to general reserve, and a further dividend of 2 per cent., making 4 per cent. for the year, is recommended, carrying forward £991.

Reduction of Capital.—*Robt. W. Blackwell & Co., Ltd.*—A petition for reducing the capital from £250,000 to £50,000, by cancelling capital which has been lost or is unrepresented by available assets, is to be heard on May 30th.

Great Northern Telegraph Co., Ltd., of Denmark.—The receipts for 1915 were £968,589, and the expenditure was £287,461. Dividends and bonus proposed aggregate 22 per cent. for the year, leaving £76,406 to be carried forward.

Cleveland & Durham County Electric Power Co.—The *London Gazette* of May 23rd contains the full statement of capital expenditure and revenue of this company for the year ended December, 1915.

Bombay Electric Supply & Tramways Co., Ltd.—The directors recommend a dividend on the ordinary shares at the rate of 7 per cent. for the year ended December 31st, 1915.

Castner-Kellner Alkali Co., Ltd.—Interim dividend, 9 per cent. for the six months ended March 31st.

Adelaide Electric Supply Co., Ltd.—Interim dividend 5 per cent., free of tax, on the ordinary shares.

Doulton & Co., Ltd.—Dividend 5 per cent., less tax, on the preference shares for year 1914.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING APRIL, 1916.

The April returns of electrical export and import business, which we tabulate below, show as regards the former a general falling-off in values, while the total of the latter shows a very considerable increase.

The exports, which in March were valued at £432,396, fell in value to £353,266 in April, the decrease in the total being mainly attributable to the falling-off in the machinery, cable, telegraph and telephone exports, while only in three sections were minor increases in value recorded.

On the other hand, the imports, which in March reached a total value of only £196,251, in April amounted to £256,099. This considerable increase is due to the greater values, particularly of machinery, of telephonic and telegraphic material—which more than doubled the March values—and of glow lamps, which were imported into this country.

Battery imports were also in advance of the previous month's value, while carbon and cable imports were on a reduced scale.

The re-exports for the month were valued at £15,391, as compared with £17,383 in March.

India, as usual, was our best market during the month, while the Australian States and France were also prominent customers.

Of the importers, the United States naturally heads the list, with a total of £175,060—largely machinery and telephonic material; Holland occupies a prominent second place, due to her sending us nearly £35,000 worth of glow lamps—a record amount, last month's figure being £21,600 worth. Business with the Scandinavian countries also was on a larger scale.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,804	4,453	45	181	774	1,718	7,263	180	245	634	2,218	2,684	22 199
Netherlands, Java and Dutch Indies ...	2,208	12,566	204	...	...	...	170	...	106	19	258	14,220	2,974
Belgian Congo	10	...	...	...	...	...	...	...	...	...	23	172	205
France	2,746	2,463	18	115	326	...	11,790	5,941	476	173	1	2,645	26,859
Portugal	303	2,617	45	42	...	16	...	...	102	...	703	192	4,020
Spain, Canary Isles and Spanish N. Africa...	356	336	152	82	94	600	2,087	555	46	...	211	516	5,035
Switzerland, Italy and Austria-Hungary ...	...	55	...	...	...	195	969	71	20	...	2,566	2,506	6,382
Greece, Roumania, Turkey and Bulgaria ...	...	...	...	...	...	...	...	...	...	...	...	...	...
Channel Isles, Gibraltar, Malta and Cyprus...	57	226	272	107	...	...	103	11	282	...	...	6,200	17,258
U.S.A., Philippines and Cuba	388	7	233	...	...	145	499	600	28	33	4	1,197	3,134
Canada and Newfoundland	310	10	34	100	...	619	1,950	...	1,661	25	430	658	5,797
British West Indies and British Guiana ...	59	138	...	34	69	...	98	...	...	23	...	44	465
Mexico and Central America	...	...	6	...	...	...	5	...	...	...	...	...	11
Peru and Uruguay	1	...	135	103	...	33	129	44	...	...	...	...	445
Chile	330	353	23	121	...	...	4,053	390	...	...	...	...	5,270
Brazil	62	526	20	121	...	77	588	135	785	51	167	107	2,639
Argentina	998	3,044	1,000	412	...	1,035	1,941	91	423	341	1,809	99	11,193
Colombia, Venezuela, Ecuador and Bolivia...	13	394	...	83	...	103	30	...	...	...	227	45	909
Egypt, Tunis and Morocco	218	1,926	...	182	...	85	984	...	1,398	...	494	309	5,596
British West Africa	61	88	18	198	...	31	1,021	...	14	...	491	211	2,133
Rhodesia, O.R.C. and Transvaal	721	1,854	456	1,089	608	186	1,964	...	279	18	14	1,094	8,283
Cape of Good Hope	255	4 763	383	226	...	496	2,233	217	1,291	...	1,009	365	11,238
Natal	1,145	1,939	33	220	...	123	5,793	98	1,070	42	196	...	10,659
Zanzibar, Brit. E. Africa, Mauritius & Aden	68	31	...	...	...	...	132	...	...	...	...	114	345
Azores, Madeira and Portuguese Africa ...	12	21	...	48	...	...	55	9	20	41	...	13	219
French African Colonies and Madagascar ...	...	...	...	...	...	...	...	...	...	...	...	...	...
China and Siam	453	1,431	200	85	...	630	2,115	2,145	394	255	294	462	8,464
Japan and Korea	56	262	...	93	...	1,664	817	52	1,310	16	...	495	4,765
India	3,946	16,595	2 579	2,113	99	1,607	19,127	660	6,296	62	1,321	309	54,714
Ceylon	54	638	289	271	...	113	115	99	287	...	...	845	2,714
Straits Settlements, Fed. Malay States and Sarawak	158	1,051	194	499	...	294	255	43	447	12	194	160	3,307
Hong Kong	444	2,621	5	237	...	10	319	...	65	...	277	31	4,009
West Australia	187	2,585	304	...	...	1,030	476	...	...	1	324	563	5,470
South Australia	117	683	83	81	...	167	797	741	45	...	960	8	3,682
Victoria	2,671	17,636	709	1,388	94	178	3,623	217	296	17	1,152	3	27,984
New South Wales	1,065	7,775	732	1,551	277	2,712	7,264	1,351	...	31	11,712	710	35,180
Queensland	...	625	108	150	...	103	453	208	1,967	83	5,536	46	9 279
Tasmania	20	...	14	140	16	...	55	...	...	...	...	...	245
New Zealand and Fiji Islands	992	2,972	456	913	5	677	3,292	1,184	522	86	2,234	78	13,411
Total; £	22,288	92,684	8,915	10,998	2,362	14,652	82,574	15,042	19,875	1,963	34,822	47,101	353,266

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	42	...	...	...	1,746	562	6,358	...	3,749	1,042	4,615	18,144
Germany	...	...	...	...	...	...	...	...	...	...	...	...
Holland...	...	461	...	34,532	321	...	157	...	67	...	...	35,538
Belgium	...	...	...	...	...	...	...	...	...	...	...	...
France	156	...	33	137	439	1,003	132	...	9,015	1,263	144	12,322
Switzerland	2,266	...	29	291	...	2,328	2,502	...	581	420	278	8,698
Italy	90	4,309	...	...	...	...	160	570	...	100	...	5,229
Austria-Hungary	...	...	...	...	...	...	...	...	...	...	...	...
United States	6,591	1,342	516	3,886	2,669	1,230	12,442	86,094	3,732	6,998	49,560	75,060
Total, £	9,145	6,112	578	38,846	5,175	5,123	21,751	86,664	17,147	9,823	54,627	254,991

Additional imports.—Spain, carbons, £45; Japan, electrical fittings, £100; glow lamps, £320; meters, £212; Egypt, goods, £28; arc lamps, £13; machinery, £5; telegraph and telephone cables, £5; Canada, electrical goods, £85; fittings, £55; telegraph and telephone cables, £240.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above... ...	1,032	1,428	...	3,831	62	1,839	3,799	...	61	87	3,216	15,391

TOTAL EXPORTS: £353,266 TOTAL RE-EXPORTS: £15,391 TOTAL IMPORTS: £256,099

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

THE SHILDON-NEWPORT RAILWAY ELECTRIFICATION.

The North-Eastern Railway Co. was one of the first of our great railway companies to adopt electric traction, having as far back as 1904 successfully applied electrical operation to their Newcastle and Tyneside suburban traffic. Once more this company has acted as a pioneer of electric traction in applying it to heavy freight haulage on the Shildon-Newport line, on which electric working was first started on July 1st, 1915.

Following a report by Messrs. Merz & McLellan, the company's consulting electrical engineers, the Shildon-Newport route was selected for trial as being an important freight line, dealing almost exclusively with heavy mineral traffic.

Some historical interest attaches to this selection, since the track runs over a portion of the original Stockton to Darlington railway, the first public railway on which steam locomotives were used for conveying passengers and goods.

Beyond the usual considerations affecting the decision to apply electric traction to such a line, a special factor which differentiated the North-Eastern Railway lines from others in the United Kingdom was the ample supply of cheap electrical energy available from the systems of the existing power companies, and this fact, obviating the necessity for a large capital expenditure by the railway company on power-station plant, had an important bearing on the whole scheme.

The electrified line, between 18 and 19 miles long, connects the mineral sidings at Shildon with the Erimus siding at Newport, near Middlesbrough (fig. 1); considerable portions of the sidings at both ends are also electrified, so that, including the sidings, about 50 miles of single track are equipped for electric working.

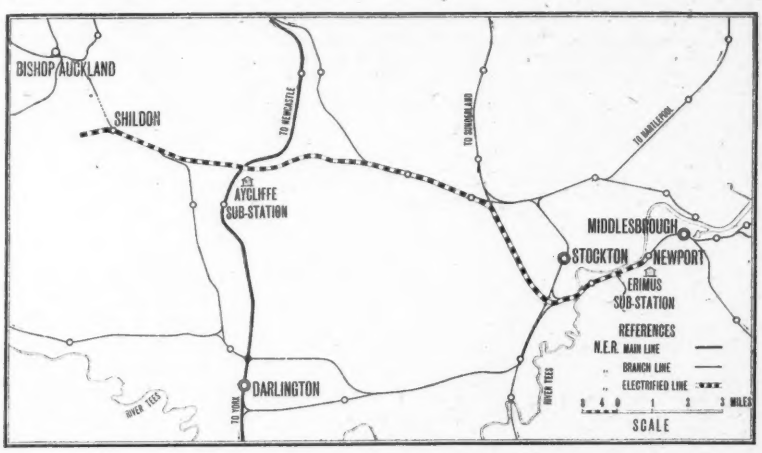


Fig. 1.—Route Plan of the Shildon-Newport Electric Railway.

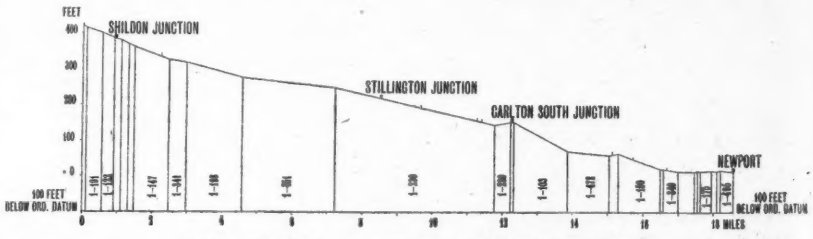


Fig. 2.—Profile of the Shildon-Newport Line.

Fig. 3.—North-Eastern Electric Freight Locomotive and Train.

The general gradient, fig. 2, is in favour of the laden traffic, the steepest gradient being 1 in 103. The line carries the heavy mineral traffic from the South-West Durham coalfields to the Middlesbrough district, supplying the large number of blast furnaces

and iron works concentrated there. On the return journey, the load consists mainly of empty wagons returned to Shildon sidings.

It was decided to adopt the high-tension direct-current system, current being supplied to the locomotives through overhead contact wires at a pressure of 1,500 volts from the two rotary-converter sub-stations described later.

The overhead track equipment was carried out by Messrs. Siemens Bros. Dynamo Works, under the supervision of the railway company's then chief engineer, Mr. C. A. Harrison.

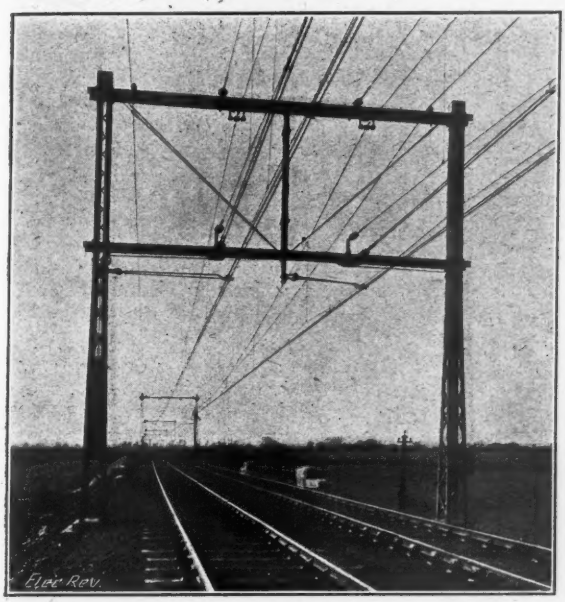
The overhead contact wires on the main portions of the track consist of two .155 sq. in. section hard-drawn copper conductors, but on certain portions of the sidings where the loads are not so heavy, a single contact wire only is used.

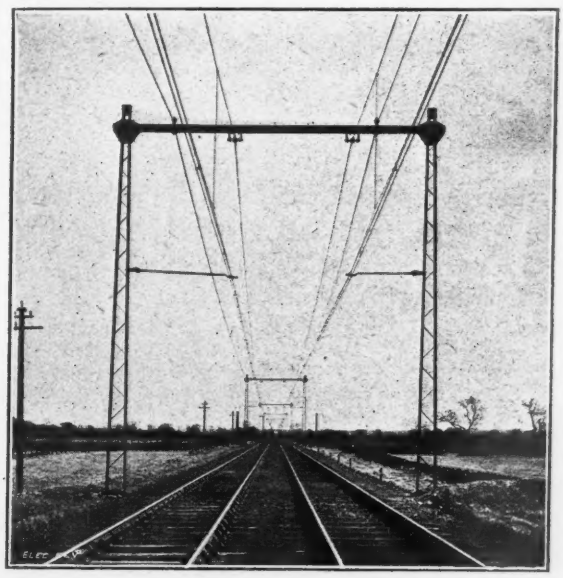
The wires are supported by a solid steel auxiliary catenary wire, to which they are attached by sliding clips. This auxiliary catenary is, in turn, suspended from the main stranded steel catenary by means of steel wire droppers. The main steel catenary wire is supported from the steel structures by means of special insulators, double insulation being used throughout (figs. 4/5).

The normal span between the steel structures is 110 yds., but on curves and sidings they are placed at lesser intervals, depending on the conditions existing.

The normal height of the contact wire from rail level is 16 ft. 6 in., but at level crossings this is increased to 18 ft. 6 in., and under some of the low bridges, of which there are a large number on this route, the height from the rail level is reduced, the minimum height being about 13 ft. 8 in.

Two auxiliary overhead stranded-copper feeder wires, each of .194 sq. in section, are connected in parallel with the main contact wires at frequent intervals, to increase the conductivity of the overhead equipment.





Figs. 4 and 5.—Typical Views of Overhead Construction Tensioning Structure in L.H. View.

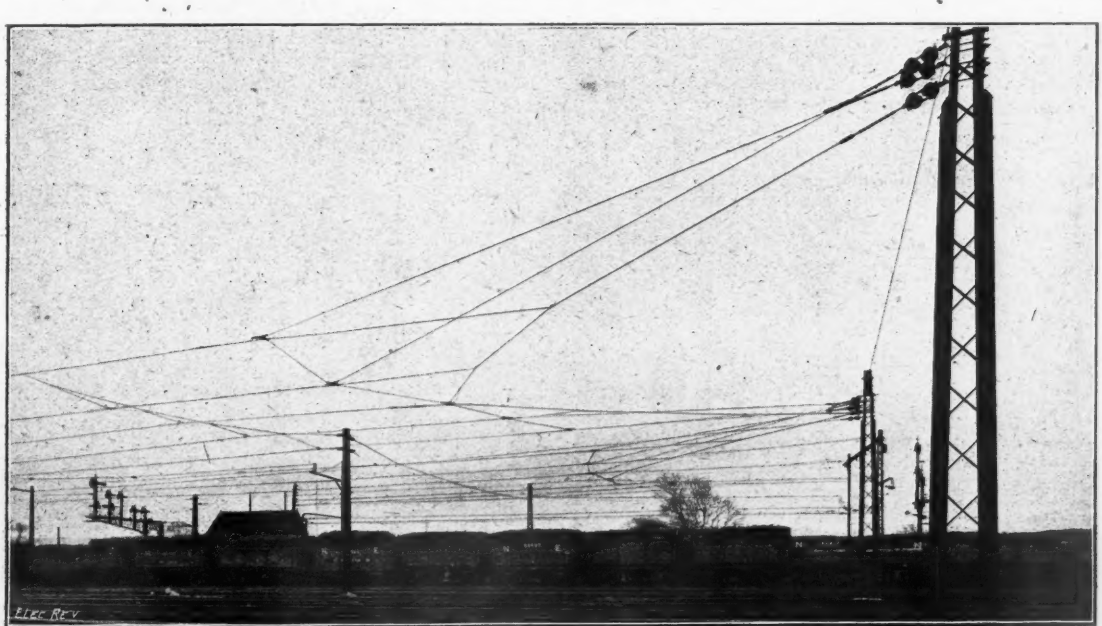


Fig. 6.—View showing Terminal Arrangement of Overhead Construction.

Each steel structure carries a pair of insulated steadying arms, pivotted in all directions and attached to the contact wires by means of clips, their purpose being to fix the position of the contact wire relatively to the track. The contact wires are staggered in the usual way to prevent undue wearing of the bow collectors.

The general types of steel structure carrying the wires over the track can be seen in our views.

These all-steel structures are bonded to the running rails by means of a hard-copper bond of No. .08 sq. in. section, and any steel structures carrying signals, which are in proximity to the electrical equipment, are also similarly bonded to the running rails.

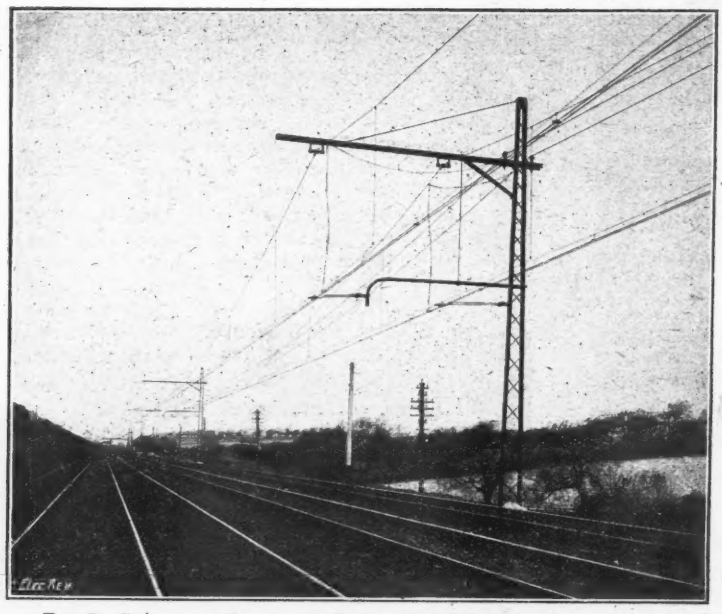


Fig. 7.—Section of Line with Cantilever Overhead Construction.

In order to limit, as far as possible, the sag of the contact wires due to temperature variation, automatic tensioning was adopted, the tensioning points being approximately 1,100 yds. apart.

Two of these structures are placed 65 yds. apart at the end of each tension length, the wires from the opposite lengths overlapping by this amount. The end of each contact wire is raised at the tensioning structure to which it is fixed, to a height of about 18 in. clear of the normal level at that point, so that the locomotive bows ride gently and without shock from one tensioning length on to the next.

The contact wires are anchored to the auxiliary catenary wire at a point two-thirds of the distance along each tensioning length in the running direction.

The tensioning weights are slung in the centre of the mast structure by chains passing over pulleys attached to the contact wire. A normal tension of about one ton is maintained by this means in the double contact wire. The auxiliary catenary wire is in all cases anchored off to the lower girder of the tensioning structure, but the main catenary is continuous, except at tensioning points at which section switches are fitted. At the latter points, the main catenary is also anchored off, but to the top girder.

On some of the sidings where only shunting work is done a single contact wire is used over each track, with ordinary tramway span wire construction.

On some of the marshalling and reception sidings, which are not equipped throughout and on which it is only necessary for the overhead construction to permit of the locomotives entering to pick up their load, the wires are terminated as shown in fig. 6.

Danger boards are fitted beyond which electric locomotives should not pass, but if by any chance they should over-run these, the terminal construction is such that no damage would be done to the bow collectors or to the overhead track.

At some of the low bridges it is possible to carry the main catenary wire through the bridge, but at most of them it is necessary to anchor it off to the bridge. In these cases, to obtain sufficient clearance, the contact wires, with the auxiliary catenary, are brought towards the centre of the bridge, and in order to prevent the edge of the bow collector from striking the bridge a guard wire is fitted.

The track is sectioned on the normal length at intervals of about 2½ miles, and considerably more frequently on sidings. Section points are arranged to occur in most cases at tensioning points, so as to avoid the use of section insulators.

Fig. 10 shows the type of section switch adopted, fitted with a horn-break arrangement, and operated by levers in the signal cabin.

Fig. 9 is a view of five section switches fitted on a girder.

As the train-control system of working is in use on this route, the signal cabins are connected by telephone with a central control office situated at Newport, and the handling of these switches is directed from the same point.

In certain positions, where it was impossible to avoid their use, section insulators are fitted, of the type shown in fig. 8. The track rails are suitably bonded at the joints and cross bonded between rails with stranded-copper bonds.

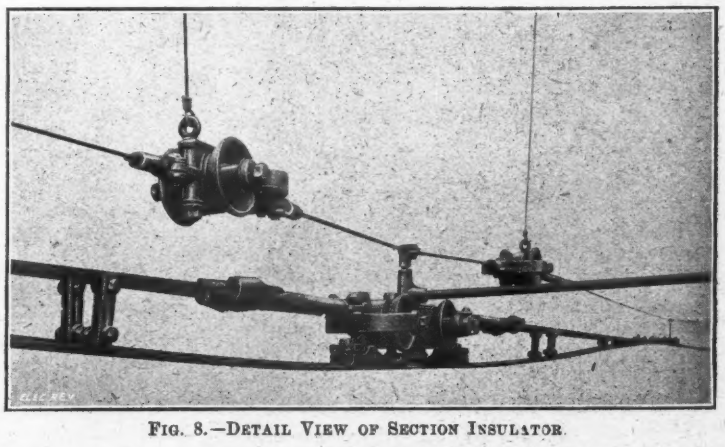


Fig. 8.—Detail View of Section Insulator.

The freight locomotives were designed and built at the N.E.R. locomotive works at Darlington, the electrical equipment being supplied and fitted by Messrs. Siemens Bros. Dynamo Works, Ltd. They are designed to haul trains weighing 1,400 tons at a speed of not less than 25 miles per hour on the level; a locomotive and train are shown in fig. 3.

The work was carried out under the direct supervision of the chief mechanical engineer, Mr. Vincent L. Raven.

The engine may be described as an articulated truck locomotive in which the tractive effort is transmitted through the truck frames.

The cab, with sloping ends, is supported on the centre of each truck by strong steel castings, which embody the centre pin bearings and side rubbing surfaces in one casting. The centre pin at No. 1 end is a good working fit in its bearings on the centre of the transom. At No. 2 end provision is made for creeping up of the trucks when passing round curves, but no allowance for movement transversely.

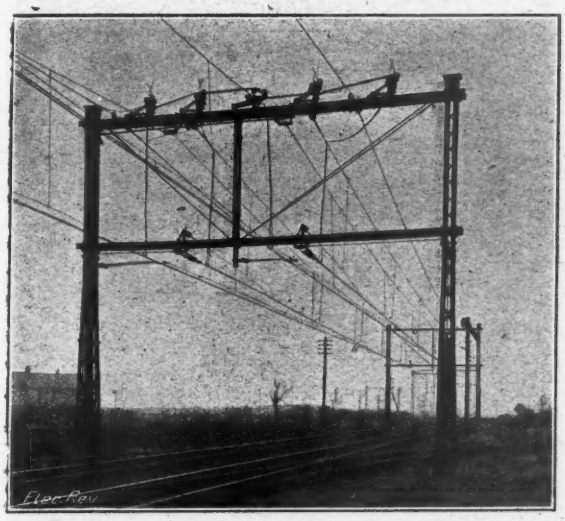


FIG. 9.—VIEW OF GANTRY WITH SECTION SWITCHES.

The trucks are securely held together by means of a draw-bar and spring, which can be adjusted (the compression of spring being $\frac{3}{8}$ in. per 7-ton load) to act as a connection between the two trucks. This spring cannot be subjected to heavy compression, resulting from buffing action, as the buffer part of the coupling between trucks receives the buffing stresses directly through the truck frames without subjecting the centre pins and platform to any stress other than that due to the weight of the cab apparatus on them.

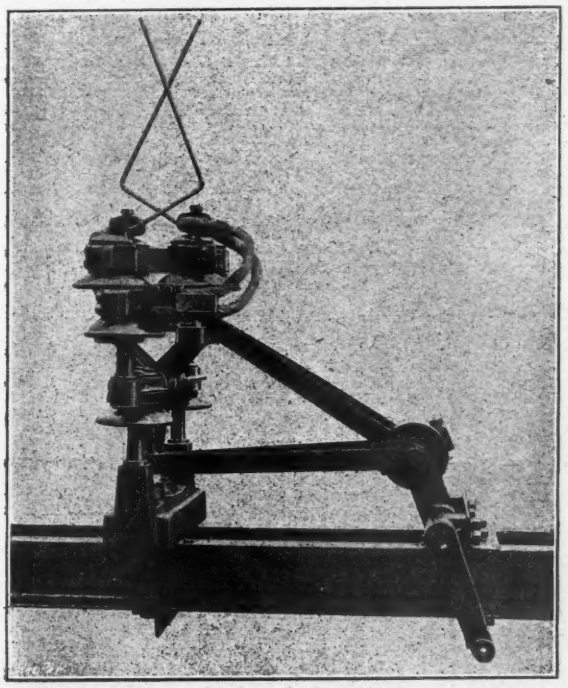


FIG. 10.—DETAIL VIEW OF SECTION SWITCH.

The sloping ends are partitioned off from the cab and contain the resistances, contactors, motor cut-out switches, multiple cut-out switches, and all high-tension electrical apparatus. Entrance to each sloping end can be obtained through doors which are normally locked.

The bow collectors on the roof of the cab are raised and maintained in connection with the contact wire by compressed air. A cock is fitted in the air system, the removable handle of which forms the key of the doors mentioned. This handle is so arranged that it can only be removed when the cock is in the exhaust position, so that it is impossible to open the doors of the sloping ends while the bows are in contact with the overhead wire.

In the cab two master controllers are fitted, one at each end. The cab also contains auxiliary switches for controlling the air compressor and the two dynamotors described later, and for lighting and heating. It also contains the control valves for the Westinghouse brake and for air sanding. In the centre of the cab there is a vertical hand wheel for the hand-brake.

The dynamotors are securely fixed to the floor, the switches, &c., being fixed on the sides of the cab and weather boards.

PARTICULARS OF MOTOR, GEARING, &c.

	tons.	cwts.
Weight of electrical equipment, inclusive of motors ...	24	5
Do. of mechanical parts	50	3
Do. of motors without gear wheels and gear cases ...	3	3
Do. do. with gear cases and gear wheels	3	13
Total weight of mechanical and electrical apparatus ...	74	8
Main dimensions of motors:—		in.
Axial length over windings		$24\frac{13}{16}$
Length over core		$11\frac{11}{16}$
Diameter of armature		$21\frac{5}{8}$
Diameter of commutator		$1\frac{7}{64}$
Length of commutator		$7\frac{3}{4}$
Number of segments		195
Air gap		$\frac{14}{64}$

Speed of motors at normal loco. speed of 25 miles per hour = 787 R.P.M.

LEADING DIMENSIONS OF LOCOMOTIVES.

	ft.	in.
Length over buffers	39	4
Width over footplate	8	4
Total wheel base	27	0
Wheel base of truck	8	9
Centres of trucks	18	3
Diameter of wheels	4	0
Height of centre of gravity	4	6

(To be continued.)

Training Electrical Housewives.—So that the housewives of to-morrow will have a clear knowledge and understanding of the various and important uses of electricity in the modern household, the Domestic Science Department of the Washington Irving High School, New York City, maintains a thorough course in electric household appliances. There are 800 girls enrolled in the Department, of which Miss Florence Willard is the head. Among other electric appliances which were installed under the supervision of the Heating Bureau of the New York Edison Co., are more than 20 electric flat irons, electrical percolators, chafing dishes, tea kettles, toasters, and grills. Some women shrank from touching anything electrical, for fear of a shock. It is the plan of E. C. Zabriskie, principal of the school, by means of this course in the domestic uses of electricity, to dispel for ever these false and ridiculous notions from the minds of the future generations of house-keepers, and teach them that electricity is their friend and servant.—*Elec. Rev. and Western Electrician.*

Protecting Canadian Power Plants.—So great is the fear that the big Canadian power plants at Niagara Falls, Ont., will be destroyed and otherwise crippled by German secret agents, that the Dominion authorities have ordered the erection of barbed-wire entanglements along part of the frontier of Canada in the vicinity of the electric generating plants. The present armed guard has been greatly increased by the arrival of additional troops from near-by concentration camps. The area of the Victoria National Park about the plant has been closed to the public. Arc lamps have been erected to illuminate the fence at night, and the cars of the Great Gorge Route Railway, which passes close to the power house, while making the loop in the vicinity of the Canadian Horse Shoe Falls, are escorted through the enclosures under armed guard.—*Electrical World.*

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

RUSSIA.—A decree dated April 1st has been issued by the Minister of Finance temporarily establishing regulations under which Customs duties must be paid on clearance of goods, not later than six months after deposit at the Port of Petrograd Custom House and two months at the Finnish Railway Station Custom House, counting from the day of the acceptance of the goods within the control of the Customs authorities.

FRENCH COLONIES.—A decree dated April 19th of the Minister for the Colonies prohibits the exportation of zinc ore to any destination except under special authorisation.

GREECE.—The exportation of searchlights and parts thereof is prohibited by Ministerial Order published on April 6th.

BRAZIL.—A revised tariff of fees to be charged by Brazilian Consular Officers has been establish by a decree, dated February 23rd, to take effect as from April 1st. The full tariff, including also the instructions for the levying of the fees, may be consulted at the Commercial Intelligence Branch of the Board of Trade.

DENMARK.—Telegraphic information has been received at the Foreign Office that the exportation of platinum and platinum wire has been prohibited.

PORTUGAL.—By a decree dated April 29th the exportation and re-exportation to foreign countries of wire and cables for electric light installations is absolutely prohibited. The decree also provides for the payment of a surtax, in addition to the ordinary export duty, on the following among other articles:—

	Rate of surtax.
Copper ore and precipitate	3 per cent. *ad valorem*.
Tin and tin ore	16 escudos per metric ton.
Wolfram	180 escudos per metric ton.
Other ores not specified	3 per cent. *ad valorem*.
Metals in the rough, in bars, in wire or scrap, and their alloys	50 per cent. *ad valorem*.
Wares of antimony, lead, copper, tin, zinc, and their alloys	50 per cent. *ad valorem*.

These articles may not be exported to foreign countries except under authority issued by the Ministry of Finance, based upon special reasons of an international character resulting from the state of war.

MEXICO.—A decree dated Feb. 20th, published in *El Constitucionalista* for March 10th, amends previous decrees respecting the export duties on Mexican produce and the suspension and reduction of Customs duties on various articles imported into Mexico. Full particulars of the revised duties are available at the Commercial Intelligence Branch of the Board of Trade.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

6,585. "Magnetically-operated prime mover or motor." W. H. HIGGINS. May 8th.

6,589. "Starting and stopping devices for electric motors." J. G. HENDERSON. May 8th.

6,594. "Electric lamps." F. B. SOARES. May 8th.

6,596. "Electrical machines for variable-speed gearing." T. VON ZWEIGBERGK. May 8th.

6,603. "Sparking plugs." K. E. L. GUINNESS. May 8th.

6,616. "Holders for incandescent electric lamps." H. LANCASTER. May 9th.

6,619. "Electric lamp sockets." W. HUNT (Bryant Electric Co.). May 9th.

6,629. "Means for telephonic communication to and from moving railway trains, &c." K. H. WARFVINGE & V. G. WERNER. May 9th. (Sweden, May 11th, 1915.)

6,639. "Electric motor control systems." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). May 9th.

6,654. "Switchboards for telephones or telegraphs." L. K. CUNNINGHAM. May 9th.

6,679. "Switches for electric battery lamps." F. WESTWOOD. May 10th.

6,682. "Railway or tramway switch-operating mechanism." A. GALSTON. May 10th.

6,696. "Means for discharging static electricity from moving-picture films, &c." C. VAN DEVENTER. May 10th. (U.S.A., May 17th, 1915.)

6,702. "Electrolytic deposition of copper from acid solutions." F. E. STUDT. May 10th.

6,735. "Electrolytic cells." C. CHURCHILL & CO. AND E. GEERAERD. May 11th.

6,737. "Synchronisation of sounds and movements." C. H. VERITY. May 11th.

6,745. "Electrical radiators." J. S. A. PRIMROSE. May 11th.

6,746. "Former for electrical radiators, &c." J. S. A. PRIMROSE. May 11th.

6,771. "Electric headlights." O. R. SELL. May 11th.

6,780. "Electric heat radiators." A. F. BERRY. May 11th.

6,809. "Sealing and bonding glands for electrical junction boxes." G. S. BOOTHROYD AND CALLENDER'S CABLE & CONSTRUCTION CO. May 12th.

6,823. "Automatic machine for manufacture of stems for metallic-filament electric lamps." J. A. ALLISON AND MORRIS & WHITHAM. May 12th.

6,836. "Sparking plugs." V. PERRETT. May 12th.

6,849. "Method of suspending metallic articles during electro-deposition." S. O. COWPER COLES. May 13th.

6,859. "Carbon holders for electric arc lamps." J. WHITE. May 13th.

6,861. "Sparking plug cut-out for internal-combustion engines." R. CROOKALL. May 13th.

6,867. "Electric lampholders." E. A. WELCH. May 13th.

6,887. "Electrically-actuated devices for electric alarms, &c." J. R. QUAIN. May 13th.

PUBLISHED SPECIFICATIONS.

1915.

5,757. MACHINES FOR INTERNALLY SHAPING TELEGRAPH INSULATORS AND THE LIKE. H. L. Doulton & W. Podmore. April 17th.

5,832. PROCESS FOR THE MANUFACTURE OF HEATING CONDUCTORS FOR THERMIC TELEPHONES FROM WIRES TREATED BY THE WOLLASTON PROCESS. Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. April 19th. (February 6th, 1915.)

5,833. SOUND CHAMBER FOR THERMIC TELEPHONES AND THE LIKE INTENDED TO BE INTRODUCED INTO THE AUDITORY PASSAGE. Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. April 19th. (February 8th, 1915.)

5,834. CONSTRUCTION OF HEATING CONDUCTORS FOR THERMIC TELEPHONES. Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. April 19th. (February 8th, 1915.)

5,835. PROCESS FOR THE MANUFACTURE OF HEATING CONDUCTORS FOR THERMIC TELEPHONES FROM WIRES MANUFACTURED BY THE WOLLASTON PROCESS. Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. April 19th. (February 9th, 1915.)

5,836. THERMIC TELEPHONES. Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. April 19th. (February 10th, 1915.)

5,837. THERMIC MICROPHONE. Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. April 19th. (February 11th, 1915.)

5,838. THERMIC TELEPHONES. Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. April 19th. (February 11th, 1915.)

5,839. THERMIC TELEPHONE WITH ADJUSTABLE SOUND EFFECT. Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. April 19th, (February 12th, 1915.)

5,840. THERMIC TELEPHONES. Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. April 19th. (February 12th, 1915.)

5,842. HEATING CONDUCTORS FOR THERMIC TELEPHONES. Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. April 19th. (February 13th, 1915.)

5,843. HEATING CONDUCTORS FOR THERMIC TELEPHONES. Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. April 19th. (March 6th 1915.)

5,844. MANUFACTURE OF HEATING CONDUCTORS FOR THERMIC TELEPHONES FROM WOLLASTON WIRES. Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. April 19th. (March 6th, 1915.)

5,845. THERMIC TELEPHONES. Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. April 19th. (March 17th, 1915.)

5,846. THERMIC TELEPHONES. Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. April 19th. (March 17th, 1915.)

5,847. THERMIC TELEPHONES. Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. April 19th. (March 17th, 1915.)

5,918. ELECTRICAL APPARATUS HAVING WINDINGS OR OTHER PORTIONS IN WHICH RESONANCE PHENOMENA MAY OCCUR. British Thomson-Houston Co. (General Electric Co., U.S.A.). April 20th.

6,542. ELECTRIC SIGNALLING SYSTEM FOR RAILWAYS. W. J. Mackenzie. May 1st.

6,586. THERMIC TELEPHONES AND MICROPHONES. R. A. B. Van Lynden and Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. May 3rd. (Cognate application 12,256/15.)

7,016. PROCESS FOR THE MANUFACTURE OF TAPES CONTAINING PARALLEL ELECTRIC WIRES. A. de Capitani. May 10th. (May 9th, 1914).

7,092. CONTROLLING MEANS FOR ELECTRICALLY-PROPELLED VESSELS. Svenska Turbinfabriks Aktiebolaget Ljungström. May 11th. (September 17th, 1914.)

7,311. COMBINED INTERRUPTER AND RECTIFIER FOR THE PRODUCTION OF UNIDIRECTIONAL HIGH-TENSION IMPULSES OF LARGE CAPACITY AS USED FOR X-RAY WORK. A. C. Gunstone. May 15th.

7,864. SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. M. G. W. Burton. May 27th.

8,107. OIL-COOLED TRANSFORMERS. British Electric Transformer Co. & W. McWilliam. June 1st.

9,519. MAGNETO IGNITION DEVICES FOR INTERNAL-COMBUSTION ENGINES. A. F. Payne. June 30th.

9,635. WINDING DEVICES FOR CONDUCTORS CONVEYING POWER TO MOVABLE ELECTRICALLY-DRIVEN MACHINES. H. S. Cassel. July 1st.

9,697. SHADE-CARRYING ELECTRIC LAMPHOLDERS. F. W. Dullingham. July 3rd.

10,026. ELECTRIC JUNCTION BOX. G. H. Scholes. July 9th.

13,600. ELECTRIC LAMPHOLDERS. T. H. A. Brown. September 24th.

16,155. GLANDS OR GRIPS FOR SECURING ELECTRIC CABLES AND THE LIKE. E. A. Graham. November 16th.

16,780. SWITCHES FOR ELECTRIC CYCLE LAMPS. F. Westwood. November 29th. (Divided application on 7,909/15, May 28th.)

1916.

3,534. ELECTROLYTIC CONDENSER OR ELECTROLYTIC VALVE. G. Giles. March 9th. (March 9th, 1915.) Patent No. 100,157.

3,780. TOOLS FOR INTERNALLY SHAPING TELEGRAPH INSULATORS AND THE LIKE. H. L. Doulton & W. Podmore. April 17th, 1915. (Addition to 21,923/14. Divided application on 5,757/15.) Patent No. 100,261.

New Electric Signal Lamp.—Mr. E. G. Fischer, Chief of the Instrument Section of the Coast and Geodetic Survey, Department of Commerce, has just completed the design and construction of a signal lamp, which will be used during the coming summer in the mountainous regions of Idaho and Oregon on primary triangulation, where the distance between stations is frequently as much as 100 miles. This lamp has been tested by the Bureau of Standards, and shown to be more than 150 times as powerful as the acetylene signal lamps, which have been used for a number of years by the Survey. These acetylene lamps have been observed with the telescope over lines more than 120 miles in length. The new lamp is an electric one, with a specially designed filament, and the energy is derived from ordinary dry cells. While no tests have been made in the field with the new lamp, it is expected that ordinary haze or smoke will seldom prevent observations.—*U.S.A. Commerce Reports.*